

# EXHIBIT 20

VS000637

U.S. Patent

Dec. 31, 2002

Sheet 5 of 16

US 6,501,641 B1

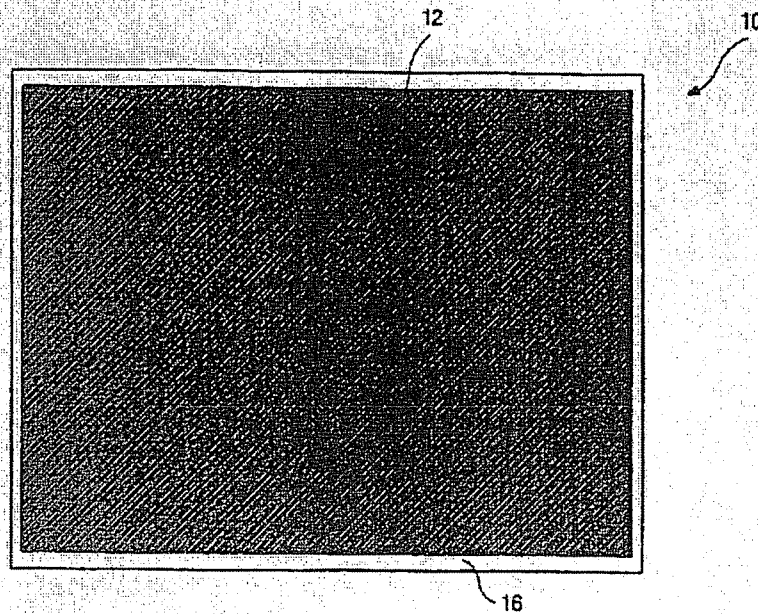


FIG. 4A

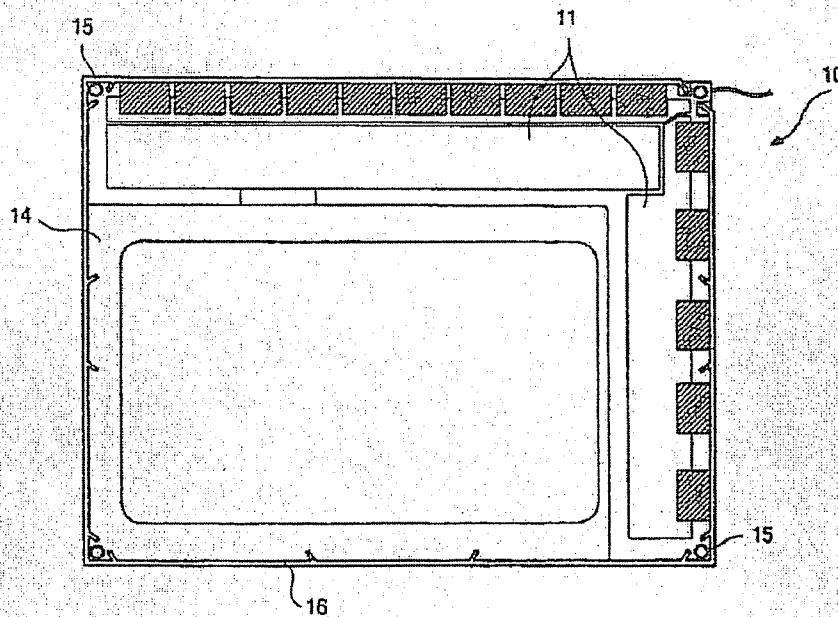
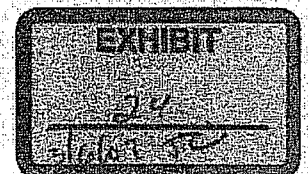


FIG. 4B

VS 00637



# EXHIBIT 21

VS000637

U.S. Patent

Dec. 31, 2002

Sheet 5 of 16

US 6,501,641 B1

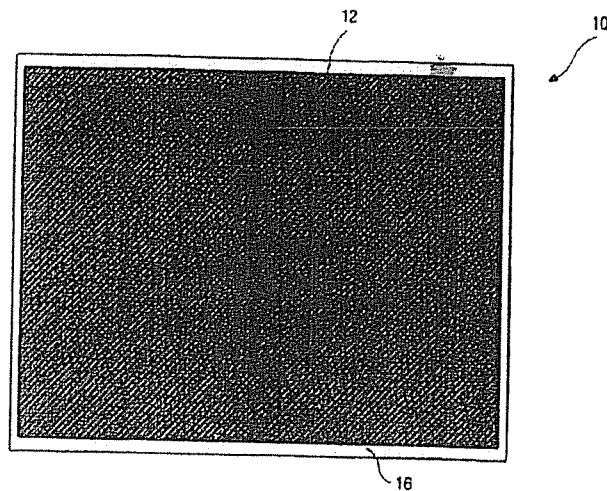


FIG. 4A

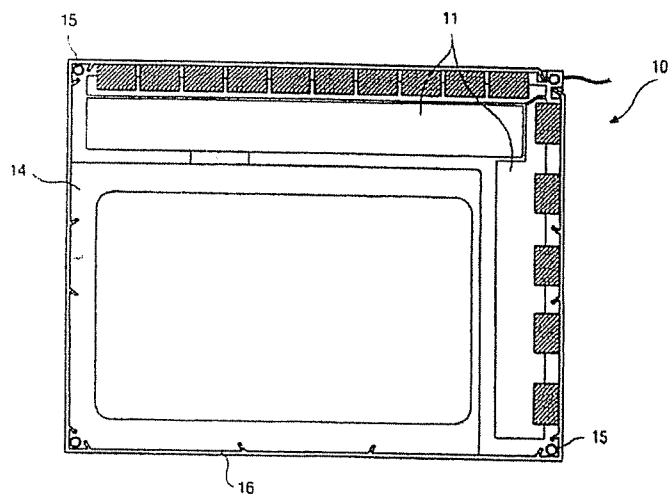


FIG. 4B



VS 00637

# **EXHIBIT 22**

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

LG.PHILIPS LCD CO., LTD.,

Plaintiff,

v.

TATUNG COMPANY; TATUNG  
COMPANY OF AMERICA, INC.;  
and VIEWSONIC CORPORATION,

Defendants.

Civil Action No. 04-343-JJF

**PLAINTIFF'S FIFTH SUPPLEMENTAL OBJECTIONS AND ANSWERS TO  
DEFENDANT VIEWSONIC CORPORATION'S FIRST SET OF INTERROGATORIES**

Plaintiff LG.Philips LCD Co., Ltd. ("LPL"), by counsel and pursuant to Fed. R. Civ. P. 26 and 33, supplements its objections and responses to Defendant ViewSonic Corporation's ("ViewSonic") First Set of Interrogatories as follows.

**PRELIMINARY STATEMENT & GENERAL OBJECTIONS**

LPL hereby incorporates its Preliminary Statements and its General Objections from Plaintiff's previous Objections and Answers to Defendant ViewSonic Corporation's First Set of Interrogatories dated March 24, 2006. Those general objections apply to each Interrogatory herein and thus, for convenience, are not repeated after each Interrogatory, and are hereby incorporated into each response.

This set of Objections and Responses incorporates into this single document all of LPL's previously-submitted supplemental objections and responses to Defendant ViewSonic Corporation's First Set of Interrogatories as well as any of LPL's previous supplemental responses.

VA2012wb, VP150m, VP230mb, VP930b, VP2030b, VE710s, VG920, VG2021m, N2000, N2010, VX2235wm, VP920b, VA703b, VA1912wb, VA1930wm, VX2035wm, VX2245wm, VG730m, VG730m, VG2030wm, VX1945wm, VG2230wm, VA712b, VP201b, Optiquet Q9, Optiquet Q7B-3, VA702b, VG910b, VX715, VP171b, N2750w and VA912b. LPL reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise, at least for the reasons set forth in LPL's response to Interrogatory No. 1, which are incorporated herein by reference.

**INTERROGATORY NO. 5:**

Identify each third party and their respective product(s) that LPL has identified as an unlicensed user and/or infringer of one or more of the Patents-in-Suit.

**OBJECTIONS AND ANSWER:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL's positions concerning any third parties and third party products in anticipation of litigation, and or any related attorney work or communication, for example, are not relevant or discoverable. LPL further objects to this Interrogatory as overly broad and because any confidential pre-suit negotiations and settlement discussions are not reasonably calculated to lead to discovery of admissible evidence and are not discoverable. Subject to and without waiving these objections and the general objections, and based upon the information presently available, LPL states as follows:

LPL has identified Fujitsu and Sharp Corporation (and any affiliated entities, distributors, and resellers that import, offer to sell, or sell their infringing products) as third parties that may infringe the Patents-in-Suit. LPL reserves the right to assert infringement claims against additional defendants in this or other cases. LPL reserves the right to supplement this

Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise.

**SUPPLEMENTAL RESPONSE & OBJECTION:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL's positions concerning any third parties and third party products in anticipation of litigation, and or any related attorney work or communication, for example, are not relevant or discoverable. LPL further objects to this Interrogatory as overly broad and because any confidential pre-suit negotiations and settlement discussions are not reasonably calculated to lead to discovery of admissible evidence and are not discoverable. LPL further objects to this Interrogatory on the grounds that it seeks information that is neither relevant to the parties' claims or defenses nor reasonably calculated to lead to the discovery of admissible evidence. LPL also objects to this Interrogatory to the extent that the discovery sought is obtainable from some other source that is more convenient, less burdensome, or less expensive, and because the burden or expense of the proposed discovery outweighs its likely benefit, taking into account the needs of the case, the amount in controversy, the parties' resources, the importance of the issues at stake in the litigation, and the importance of the proposed discovery in resolving the issues.

Subject to and without waiving these objections and the general objections, and based upon the information presently available, LPL states as follows: LPL's representatives attended confidential meetings with representatives of Fujitsu on May 20, 2003, at LG.Philips LCD Japan Office in Tokyo. LPL met with representatives of Fujitsu's IP licensing department, Patent Department IV, and Technology Alliance Department 1. These meetings were attended by the following people: Jong Hwan Lee (LPL), Ho Lee (LPL), Young Woo Cho (LPL), Won Jun Choi (LPL), Myeong Jo Seo (LPL), Kakegawa (Fujitsu), Koyasu (Fujitsu), Miyake (Fujitsu), Ozawa



(Fujitsu), Nakamura (Fujitsu), Yamaguchi (Fujitsu), Sato (Fujitsu), Ohashi (Fujitsu), Sakoda (Fujitsu), and Hoshino (Fujitsu). LPL and Fujitsu discussed the Fujitsu Siemens 5110FA monitor and the Fujitsu Monitor VL1700SS. Fujitsu did not make a presentation to LPL, nor did it distribute any documents at these meetings.

LPL's representatives attended confidential meetings with representatives of Sharp on November 7, 2003, at LG.Philips LCD in Anyang, Korea. LPL met with representatives of Sharp's Licensing department and Patent department. These meetings were attended by the following people: Ho Lee (LPL), Jong Hwan Kim (LPL), Young Woo Cho (LPL), Won Jun Choi (LPL), Kubota (Sharp), Himeno (Sharp), Masanori (Sharp), and Hirashi (Sharp). LPL and Sharp discussed the SharpLL-T1620-H and the LC-20B4U-S. Sharp did not make a presentation to LPL, nor did it distribute any documents at these meetings.

LPL reserves the right to assert infringement claims against additional defendants in this or other cases. LPL reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise.

#### **INTERROGATORY NO. 6:**

State all material facts relating to your contention that you are entitled to damages from ViewSonic for the alleged infringement of the Patents-in-Suit, including identifying the first date upon which you allege infringement damages against ViewSonic began to accrue; identifying the amount of damages that you contend you are entitled to receive from ViewSonic, including a specific identification of the amount of reasonable royalties sought; stating the bases for LPL's calculation of damages; and identifying by production number of all documents that support or refute any of LPL's contentions concerning damages.

#### **OBJECTIONS AND ANSWER:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. Also, LPL objects to this Interrogatory as seeking information on damages that is premature and unavailable, including because LPL is awaiting discovery from ViewSonic. LPL also objects to the term "accrue" to the extent this

**INTERROGATORY NO. 7:**

If you contend that there is a nexus between the claimed inventions of either or both of the Patents-in-Suit and the commercial success of any ViewSonic product that incorporates an LCD display that allegedly infringes that patent, identify on a claim-by-claim basis all factual bases for that contention and all documents that support that contention.

**OBJECTIONS AND ANSWER:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL is awaiting discovery from ViewSonic and reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise.

**SUPPLEMENTAL OBJECTIONS & ANSWER:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL also objects to this Interrogatory as premature and seeking information in ViewSonic's possession and that is the subject of LPL's discovery requests. LPL is awaiting discovery from ViewSonic and reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise. LPL further objects to this Interrogatory on the grounds that it seeks information that is neither relevant to the parties' claims or defenses nor reasonably calculated to lead to the discovery of admissible evidence. LPL also objects to this Interrogatory to the extent that the discovery sought is obtainable from some other source that is more convenient, less burdensome, or less expensive, and because the burden or expense of the proposed discovery outweighs its likely benefit, taking into account the needs of the case, the amount in controversy, the parties' resources, the importance of the issues at stake in the litigation, and the importance of the proposed discovery in resolving the issues.

Subject to and without waiving these objections, and based on the information available on the date these responses were prepared, LPL responds that evidence of commercial success includes the fact that the technology protected by the Patents-in-Suit is, to LPL's knowledge, widely employed in the industry, and that users of the technology include competitors of both Tatung and ViewSonic. Moreover, LPL will later supplement its response after Defendants produce the information sought by LPL's written discovery requests and after LPL conducts its oral examination of Defendants' witnesses. LPL reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise.

**SECOND SUPPLEMENTAL OBJECTIONS AND ANSWER:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL also objects to this Interrogatory as premature and seeking information in ViewSonic's possession and that is the subject of LPL's discovery requests. LPL is awaiting discovery from ViewSonic and reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise. LPL further objects to this Interrogatory on the grounds that it seeks information that is neither relevant to the parties' claims or defenses nor reasonably calculated to lead to the discovery of admissible evidence. LPL also objects to this Interrogatory to the extent that the discovery sought is obtainable from some other source that is more convenient, less burdensome, or less expensive, and because the burden or expense of the proposed discovery outweighs its likely benefit, taking into account the needs of the case, the amount in controversy, the parties' resources, the importance of the issues at stake in the

litigation, and the importance of the proposed discovery in resolving the issues. Subject to and without waiving these objections, LPL states as follows:

The technology protected by the Patents-in-Suit is widely employed in the industry, including by Defendants Tatum and ViewSonic, as well as other companies. ViewSonic, for example, has imported and sold infringing products such as the VX900, VX2000, VA503b, VG2021m, N2000, VP2030b, VX700, VX924, VG920, VP230mb, and VP930b LCD monitors. ViewSonic states that it is “the #1 best-selling monitor brand in the USA, delivering price and performance leadership.” *See* VS015414. The total quantity and value of ViewSonic’s infringing U.S. sales and imports is known to ViewSonic and will be established at trial. LPL is awaiting discovery from ViewSonic and others to confirm the full extent of infringing sales and imports in and to the U.S.

ViewSonic’s use of LPL’s patented technology minimizes the non-display area of its LCD display products and contributes to the commercial success of ViewSonic’s infringing products. One object of both Patents-in-Suit is “to minimize the non-display area of the LCD device.” ‘718 Patent at col. 2:50-51; ‘641 Patent at col. 2:47-48. ViewSonic uses the patented technology to achieve this goal for products that incorporate LCD displays and infringe one or both Patents-in-Suit. For example, ViewSonic promotes its reduced bezel area as a significant feature for infringing ViewSonic products. ViewSonic has marketed this advantage of using less bezel area, referred to by ViewSonic as, for example, a “slim bezel” feature (regarding, for example, VA503b and VX924 monitors; *see, e.g.*, VS015854, VS015540, VS015833, and VS016005), or an “ultra-thin bezel” feature (regarding, for example, VG920 monitors; *see, e.g.*, VS015657, VS015659, and VS015914), and “ultra-slim bezel design” (regarding, for example, VP930b monitors; *see* LPL 11409-410). With respect to the VP930b monitor, for example,

ViewSonic states that the “ultra-slim” bezel design “enhances your visual experience with clean, minimalist borders around the active image area.” (LPL 11410). As another example, regarding the VG920 monitor, ViewSonic states that the “viewable screen in an ultra-thin bezel lets you see more without taking up valuable desktop real estate.” (*See, e.g.*, VS015657, VS015659, and VS015914.) Additional documents reflecting ViewSonic’s marketing and/or description of bezel / design-related features regarding infringing products include, for example: VS16105 (VA503B, “slim bezel”); VS16148 (same); VS15675 (VP2030b, “ultra-slim bezel”); VS15677 (same); VS16038 (VX924, “floating head, slim bezel design”); and VS15657 (VG920, “ultra-thin bezel lets you see more”). LPL is continuing to investigate the relationship between LPL’s patented technology and the commercial success of ViewSonic’s infringing products.

Tatung Company also makes products under its own and other brands, which is the subject of ongoing discovery. LPL has identified Tatung L17AMTN monitors, TLM-1705 monitors, and L17UCTT monitors, for example, as infringing products successfully sold and/or marketed by Tatung, including in the U.S. LPL is awaiting discovery from Tatung to confirm the full extent of infringing sales and imports in and to the U.S., and LPL’s investigation is continuing.

LPL also believes that other companies, including Sharp and Fujitsu-Siemens have made and sold products that practice the technology claimed in the Patents-in-Suit, further establishing the commercial success of this technology. LPL has identified Sharp’s LL-T1620-H monitor and LC-20B4U-S television, and Fujitsu-Siemens’ 5110 FA monitor, as additional examples of products that practice the patented technology claimed in the Patents-in-Suit. LPL has produced documents referencing each of these three products, bates numbered LPL 0001-0038 and LPL

07363-07400. LPL reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise.

### **THIRD SUPPLEMENTAL OBJECTIONS AND ANSWER**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL also objects to this Interrogatory as premature and seeking information in ViewSonic's possession and that is the subject of LPL's discovery requests. LPL is awaiting discovery from ViewSonic and reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise. LPL further objects to this Interrogatory on the grounds that it seeks information that is neither relevant to the parties' claims or defenses nor reasonably calculated to lead to the discovery of admissible evidence. LPL also objects to this Interrogatory to the extent that the discovery sought is obtainable from some other source that is more convenient, less burdensome, or less expensive, and because the burden or expense of the proposed discovery outweighs its likely benefit, taking into account the needs of the case, the amount in controversy, the parties' resources, the importance of the issues at stake in the litigation, and the importance of the proposed discovery in resolving the issues. Subject to and without waiving these objections, LPL states as follows:

The technology protected by the Patents-in-Suit is widely employed in the industry, including by Defendants Tatung and ViewSonic, as well as other companies. ViewSonic, for example, has imported and sold infringing products as identified in response to Interrogatory No. 1, such as the VX900, VX2000, VA503b, VG2021m, N2000, VP2030b, VX700, VX924, VG920, VP230mb, VP930b, VP2130b-1, VP191b, VP191s, VG710b, VG710s, VA903b, VE150mb, VX724, VX910, and VX922 LCD monitors. ViewSonic states that it is "the #1 best-

selling monitor brand in the USA, delivering price and performance leadership.” See VS015414.

The total quantity and value of ViewSonic’s infringing U.S. sales and imports is known to ViewSonic and will be established at trial. LPL is awaiting discovery from ViewSonic and others to confirm the full extent of infringing sales and imports in and to the U.S.

ViewSonic’s use of LPL’s patented technology minimizes the non-display area of its LCD display products and contributes to the commercial success of ViewSonic’s infringing products. One object of both Patents-in-Suit is “to minimize the non-display area of the LCD device.” ‘718 Patent at col. 2:50-51; ‘641 Patent at col. 2:47-48. ViewSonic uses the patented technology to achieve this goal for products that incorporate LCD displays and infringe one or both Patents-in-Suit. For example, ViewSonic promotes its reduced bezel area as a significant feature for infringing ViewSonic products. ViewSonic has marketed this advantage of using less bezel area, referred to by ViewSonic as, for example, a “slim bezel” feature (regarding, for example, VA503b and VX924 monitors; *see, e.g.*, VS015854, VS015540, VS015833, and VS016005), or an “ultra-thin bezel” feature (regarding, for example, VG920 monitors; *see, e.g.*, VS015657, VS015659, and VS015914), and “ultra-slim bezel design” (regarding, for example, VP930b monitors; *see* LPL 11409-410). With respect to the VP930b monitor, for example, ViewSonic states that the “ultra-slim” bezel design “enhances your visual experience with clean, minimalist borders around the active image area.” (LPL 11410). As another example, regarding the VG920 monitor, ViewSonic states that the “viewable screen in an ultra-thin bezel lets you see more without taking up valuable desktop real estate.” (*See, e.g.*, VS015657, VS015659, and VS015914.) Additional documents reflecting ViewSonic’s marketing and/or description of bezel / design-related features regarding infringing products include, for example: VS16105 (VA503B, “slim bezel”); VS16148 (same); VS15675 (VP2030b, “ultra-slim bezel”); VS15677 (same);



VS16038 (VX924, “floating head, slim bezel design”); and VS15657 (VG920, “ultra-thin bezel lets you see more”). LPL is continuing to investigate the relationship between LPL’s patented technology and the commercial success of ViewSonic’s infringing products.

Tatung Company also makes products under its own and other brands, which is the subject of ongoing discovery. LPL has identified the L15FCBT-U02 Product Group; L17ACLN-U13 Product Group; L17AMTN-U23 Product Group; L17FCBT-U02 Product Group; L17FCMT Product Group; L17ECBQ-U08 Product Group; L17UCCT-U02 Product Group; L19FCBT Product Group; L19FCMT-U05 Product Group; L20WCAQ-U19 Product Group; L22YMTT-U09 Product Group; V17AFTW Product Group; V23CLTT Product Group; Tatung P46T; and Hitachi 37HDL52 products, for example, as infringing products successfully sold and/or marketed by Tatung, including in the U.S. LPL is awaiting discovery from Tatung to confirm the full extent of infringing sales and imports in and to the U.S., and LPL’s investigation is continuing, and as such LPL reserves the right to supplement this Response as appropriate.

LPL also believes that other companies, including Sharp and Fujitsu-Siemens have made and sold products that practice the technology claimed in the Patents-in-Suit, further establishing the commercial success of this technology. LPL has identified Sharp’s LL-T1620-H monitor and LC-20B4U-S television, and Fujitsu-Siemens’ 5110 FA monitor, as additional examples of products that practice the patented technology claimed in the Patents-in-Suit. LPL has produced documents referencing each of these three products, bates-numbered LPL 0001-0038 and LPL 07363-07400.

The basis for LPL’s contentions regarding commercial success includes, but is not limited to, the information summarized above, documents produced by Defendants, and



deposition testimony, for example, the testimony of Jeff Volpe, ViewSonic's vice-president of marketing.

LPL reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise.

**INTERROGATORY NO. 8:**

State all material facts that support your contention that ViewSonic's alleged infringement has been willful.

**OBJECTIONS AND ANSWER:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL also objects to this Interrogatory as premature and seeking information in ViewSonic's possession and that is the subject of LPL's discovery requests. Subject to and without waiving these objections and the general objections, and based upon the information presently available, LPL states as follows:

ViewSonic is and/or has infringed the Patents-in-Suit, by, for example, importing, offering, marketing, and/or selling products known to infringe the Patents-in-Suit, and continuing to do so, including after LPL filed this lawsuit. ViewSonic's conduct, in disregard of LPL's allegations and patent rights, is willful, and the totality of ViewSonic's conduct, which is the subject of ongoing investigation and discovery, warrants enhanced damages, attorneys' fees, and other appropriate relief. LPL reserves the right to supplement this Interrogatory response, if appropriate, when and if additional information becomes available, or otherwise.

**SUPPLEMENTAL OBJECTIONS AND ANSWER:**

LPL objects to this Interrogatory to the extent it seeks information protected by the attorney-client privilege and/or the work product doctrine. LPL also objects to this Interrogatory as premature and seeking information in defendants' possession and that is the subject of LPL's

None of the above documents or items, either standing alone or in combination, teaches or suggests each and every element of any asserted claim in the '641 patent or the '718 patent.

LPL reserves the right to supplement this Interrogatory response, if appropriate, when and if additional information becomes available, or otherwise.

**INTERROGATORY NO. 11:**

Identify each document, search, investigation, communication or opinion (written or oral) made by LPL, or on LPL's behalf, or by any third party, concerning the validity or invalidity, enforceability or unenforceability, infringement or non-infringement, or scope of any of the claims, or Prior Art concerning the subject matter of one or more of the Patents-in-Suit, including a description of each person(s) who participated in those acts.

**OBJECTIONS AND ANSWER:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL further objects to this Interrogatory because defendants mischaracterize as one interrogatory multiple interrogatories on separate subjects; in responding, LPL counts this Interrogatory as multiple interrogatories. LPL further objects to this Interrogatory as overly broad and because any confidential pre-suit negotiations and settlement discussions are not reasonably calculated to lead to discovery of admissible evidence and are not discoverable. LPL also objects to this Interrogatory on the ground that it is overbroad and unduly burdensome because, among other reasons, it seeks "each document, search, investigation, communication or opinion (written or oral)." To the extent this Interrogatory seeks expert discovery, LPL further objects to this Interrogatory as premature. Subject to and without waiving these objections and the general objections, and based on LPL's current knowledge, LPL states as follows:

LPL's representatives have had confidential meetings with representatives of Fujitsu, and representatives of Sharp Corporation, regarding infringement of the Patents-in-Suit. During their

meetings, LPL's representatives made an electronic presentation. LPL does not have any written communications or materials from Fujitsu or Sharp, nor did they cite any alleged prior art. LPL reserves the right to supplement this Interrogatory response, if appropriate, when and if additional information becomes available, or otherwise.

**SUPPLEMENTAL OBJECTION & RESPONSE:**

LPL objects to this Interrogatory to the extent that it seeks information protected by the attorney-client privilege or the work product doctrine. LPL further objects to this Interrogatory because defendants mischaracterize as one interrogatory multiple interrogatories on separate subjects; in responding, LPL counts this Interrogatory as multiple interrogatories. LPL further objects to this Interrogatory as overly broad and because any confidential pre-suit negotiations and settlement discussions are not reasonably calculated to lead to discovery of admissible evidence and are not discoverable. LPL also objects to this Interrogatory on the ground that it is overbroad and unduly burdensome because, among other reasons, it seeks "each document, search, investigation, communication or opinion (written or oral.)" To the extent this Interrogatory seeks expert discovery, LPL further objects to this Interrogatory as premature.

LPL further objects to this Interrogatory on the grounds that it seeks information that is neither relevant to the parties' claims or defenses nor reasonably calculated to lead to the discovery of admissible evidence. LPL also objects to this Interrogatory to the extent that the discovery sought is obtainable from some other source that is more convenient, less burdensome, or less expensive, and because the burden or expense of the proposed discovery outweighs its likely benefit, taking into account the needs of the case, the amount in controversy, the parties' resources, the importance of the issues at stake in the litigation, and the importance of the proposed discovery in resolving the issues.

Subject to and without waiving these objections and the general objections, and based on LPL's current knowledge, LPL states as follows:

LPL's representatives have had confidential meetings with representatives of Fujitsu, and representatives of Sharp Corporation, regarding infringement of the Patents-in-Suit. In preparing for those meetings, LPL's representatives created and presented materials regarding such infringement. LPL does not have any written communications or materials from Fujitsu or Sharp as a result of those meetings, nor did they cite any alleged prior art.

LPL's representatives attended confidential meetings with representatives of Fujitsu on May 20, 2003, at LG.Philips LCD Japan Office in Tokyo. LPL met with representatives of Fujitsu's IP licensing department, Patent Department IV, and Technology Alliance Department

1. These meetings were attended by the following people: Jong Hwan Lee (LPL), Ho Lee (LPL), Young Woo Cho (LPL), Won Jun Choi (LPL), Myeong Jo Seo (LPL), Kakegawa (Fujitsu), Koyasu (Fujitsu), Miyake (Fujitsu), Ozawa (Fujitsu), Nakamura (Fujitsu), Yamaguchi (Fujitsu), Sato (Fujitsu), Ohashi (Fujitsu), Sakoda (Fujitsu), and Hoshino (Fujitsu). LPL and Fujitsu discussed the Fujitsu Siemens 5110FA monitor and the Fujitsu Monitor VL1700SS. Fujitsu did not make a presentation to LPL, nor did it distribute any documents at these meetings.

LPL's representatives attended confidential meetings with representatives of Sharp on November 7, 2003, at LG.Philips LCD in Anyang, Korea. LPL met with representatives of Sharp's Licensing department and Patent department. These meetings were attended by the following people: Ho Lee (LPL), Jong Hwan Kim (LPL), Young Woo Cho (LPL), Won Jun Choi (LPL), Kubota (Sharp), Himeno (Sharp), Masanori (Sharp), and Hirashi (Sharp). LPL and Sharp discussed the SharpLL-T1620-H and the LC-20B4U-S. Sharp did not make a presentation to LPL, nor did it distribute any documents at these meetings.

LPL reserves the right to supplement this Interrogatory answer, if appropriate, when and if additional information becomes available, or otherwise.

**INTERROGATORY NO. 12:**

For each reference listed below that you contend does not qualify as prior art under any provision of 35 U.S.C. §§ 102 and/or 103, set forth in detail the entire basis for your contention as to each reference, including stating all relevant facts, identifying all documents on which you rely to support your contention, and identifying all persons with information or knowledge relevant to your contention, summarizing each person's knowledge:

- (a) PixelVision SGT15P
- (b) IBM 9052
- (c) IBM 9516
- (d) Tatung L4KAS
- (e) Hewlett-Packard S1010 and/or S1010a
- (f) ViewSonic VP140
- (g) ViewSonic VPA138
- (h) "Cockpit Displays III," Darryl G. Hopper, April 10-11, 1996, SPIE – The International Society for Optical Engineering
- (i) U.S. Pat. No. 5,041,965
- (j) U.S. Pat. No. 5, 119,204
- (k) U.S. Pat. No. 5,570,267
- (l) U.S. Pat. No. 5,831,816
- (m) U.S. Pat. No. 6,068,227
- (n) JP 09-190156
- (o) JP 09-171358

categorically an entire set of Requests for Admissions (many of which, in turn, are objectionable for the reasons stated in LPL's responses to those Requests for Admissions). LPL reserves the right to supplement this Interrogatory response, if appropriate, when and if additional information becomes available, or otherwise.

DATED: April 13, 2007

THE BAYARD FIRM

/s/ Richard D. Kirk (#922)

Richard D. Kirk  
Ashley B. Stitzer  
222 Delaware Avenue, Suite 900  
P.O. Box 25130  
Wilmington, DE 19899-2306  
(302) 655-5000  
rkirk@bayardfirm.com  
Attorneys for Plaintiff  
LG.PHILIPS LCD CO., LTD.

OF COUNSEL:  
Lora Brzezynski  
Matthew T. Bailey  
Cass W. Christenson  
McKenna Long & Aldridge LLP  
1900 K Street, NW  
Washington, DC 20006  
(202) 496-7500

# **EXHIBIT 23**



US006411501B1

(12) **United States Patent**  
**Cho et al.**

(10) Patent No.: **US 6,411,501 B1**  
 (45) Date of Patent: **Jun. 25, 2002**

(54) **PORTABLE COMPUTER AND METHOD FOR MOUNTING A FLAT DISPLAY DEVICE MODULE**

(75) Inventors: **Young Woo Cho; Jong Hwan Kim; Dae Hee Park**, all of Kyonggi-do (KR)

(73) Assignee: **LG Phillips LCD Co., Ltd.**, Seoul (KR)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/437,222**

(22) Filed: **Nov. 10, 1999**

(30) Foreign Application Priority Data

Nov. 11, 1998 (KR) ..... 98-48265

(51) Int. Cl.<sup>7</sup> ..... **G06F 1/16**

(52) U.S. Cl. .... **361/681; 361/682; 361/683; 349/58**

(58) Field of Search ..... **361/679-683; 292/8, 56, 32, 94, 11; 248/917-923; 349/58, 59, 60; 16/342, 307**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,379,182 A \* 1/1995 Fujimori et al. .... 361/681

5,467,504 A \* 11/1995 Yang ..... 16/342  
 5,566,048 A \* 10/1996 Esterberg et al. .... 361/681  
 5,844,774 A \* 12/1998 Gushiken et al. .... 361/681  
 5,872,606 A \* 2/1999 Kim ..... 249/58  
 5,946,061 A \* 8/1999 Kurihara et al. .... 349/58  
 6,064,565 A \* 5/2000 Ishihara et al. .... 361/681

\* cited by examiner

*Primary Examiner*—Darren Schuberg

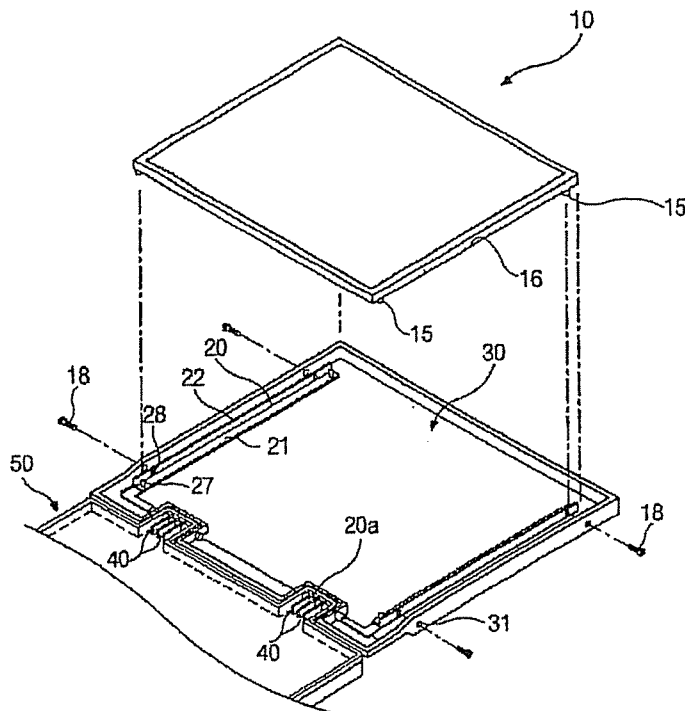
*Assistant Examiner*—Yean Hsi Chang

(74) *Attorney, Agent, or Firm*—Long Aldridge & Norman LLP

(57) **ABSTRACT**

Disclosed is a computer that includes: a system body having an input device; a display module having a display surface and a rear surface; a display case having a side wall surface; and a hinge pivotally coupling the body to the display module, the hinge including a hinge frame having first and second surfaces, the first surface coupled with the rear surface of the display module, the second surface coupled with the side wall surface of the display case.

**31 Claims, 14 Drawing Sheets**



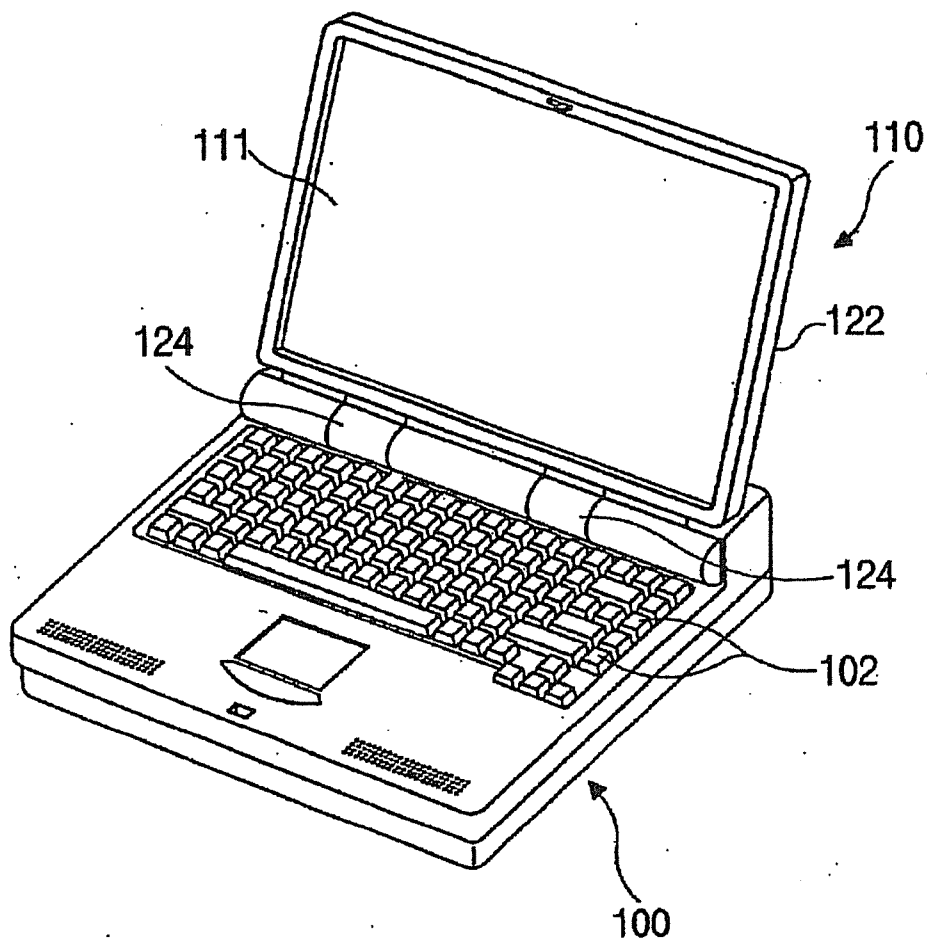


U.S. Patent

Jun. 25, 2002

Sheet 1 of 14

US 6,411,501 B1



**FIG. 1**

U.S. Patent

Jun. 25, 2002

Sheet 2 of 14

US 6,411,501 B1

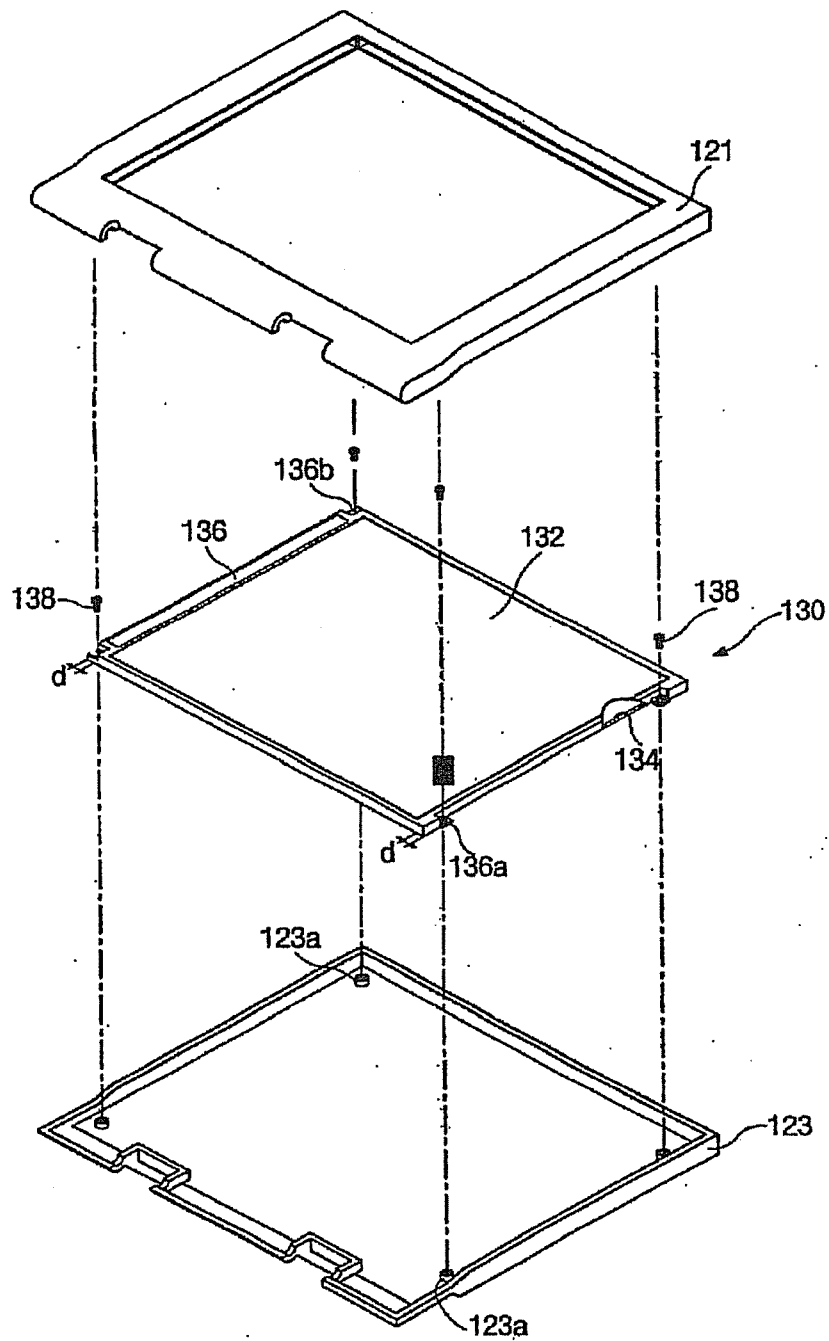


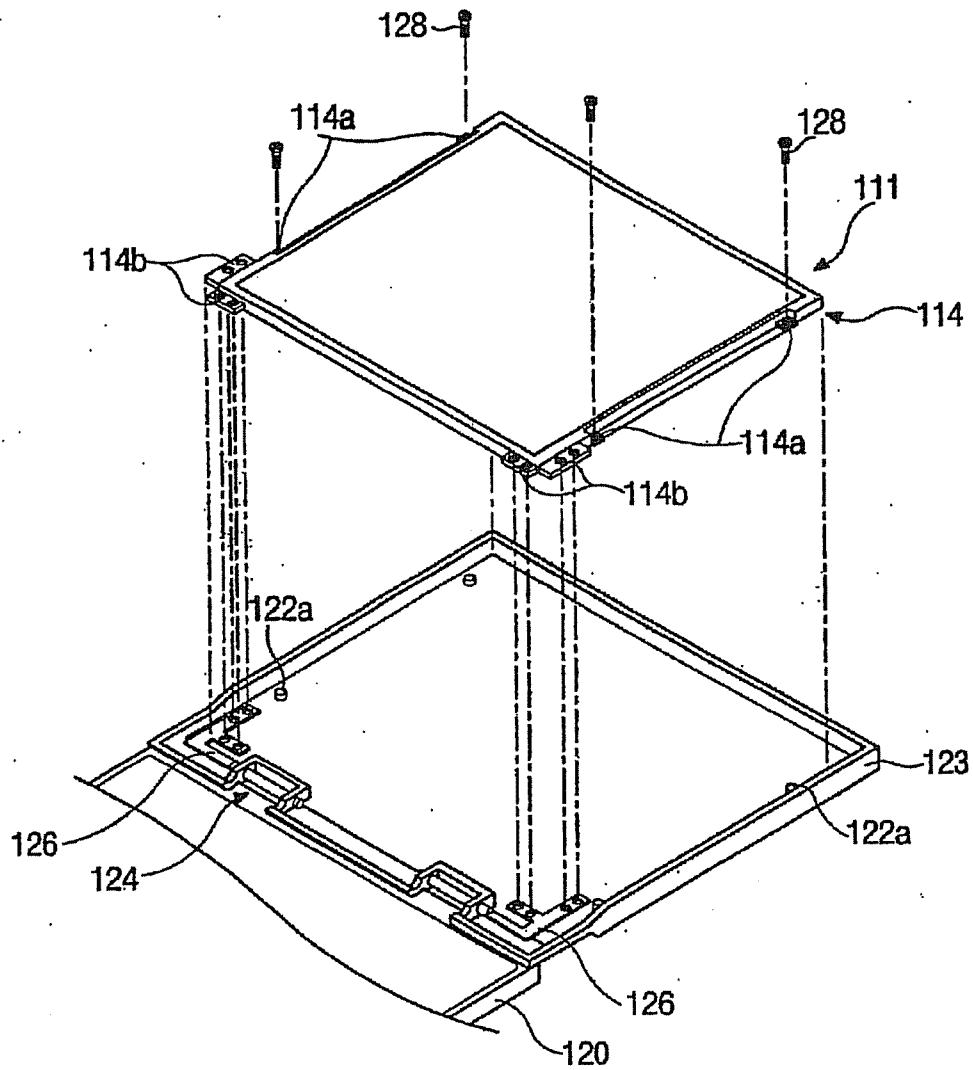
FIG. 2

U.S. Patent

Jun. 25, 2002

Sheet 3 of 14

US 6,411,501 B1



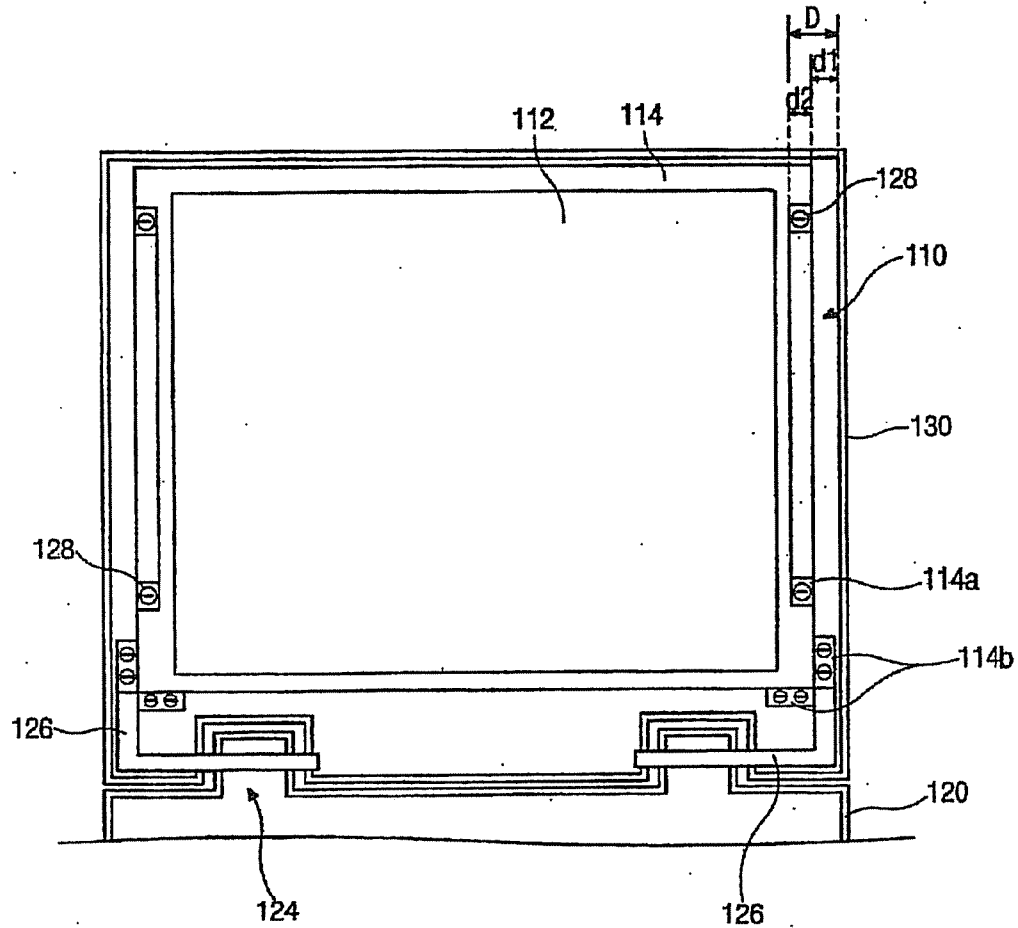
**FIG. 3A**

U.S. Patent

Jun. 25, 2002

Sheet 4 of 14

US 6,411,501 B1



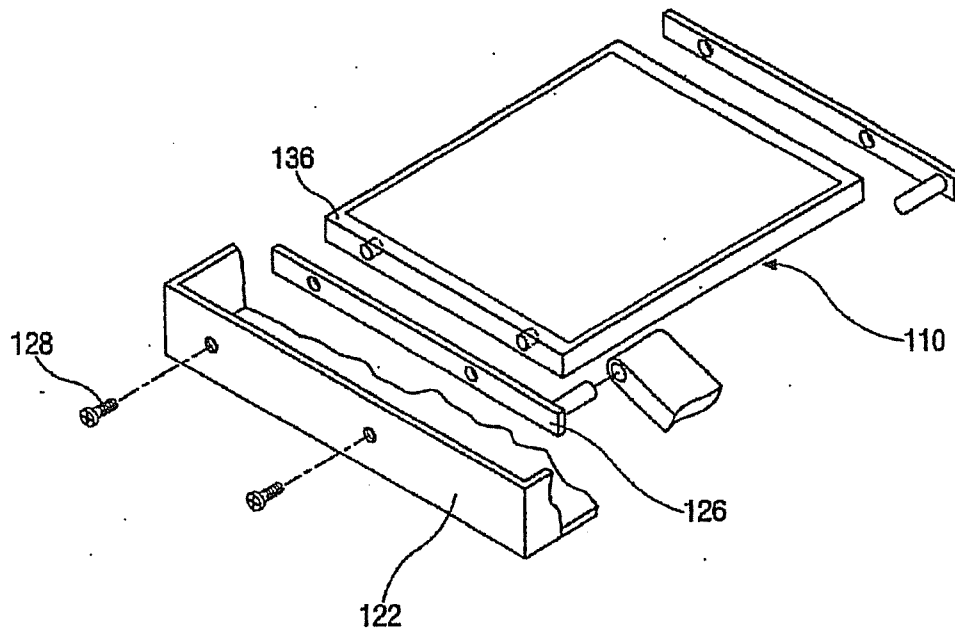
**FIG. 3B**

U.S. Patent

Jun. 25, 2002

Sheet 5 of 14

US 6,411,501 B1



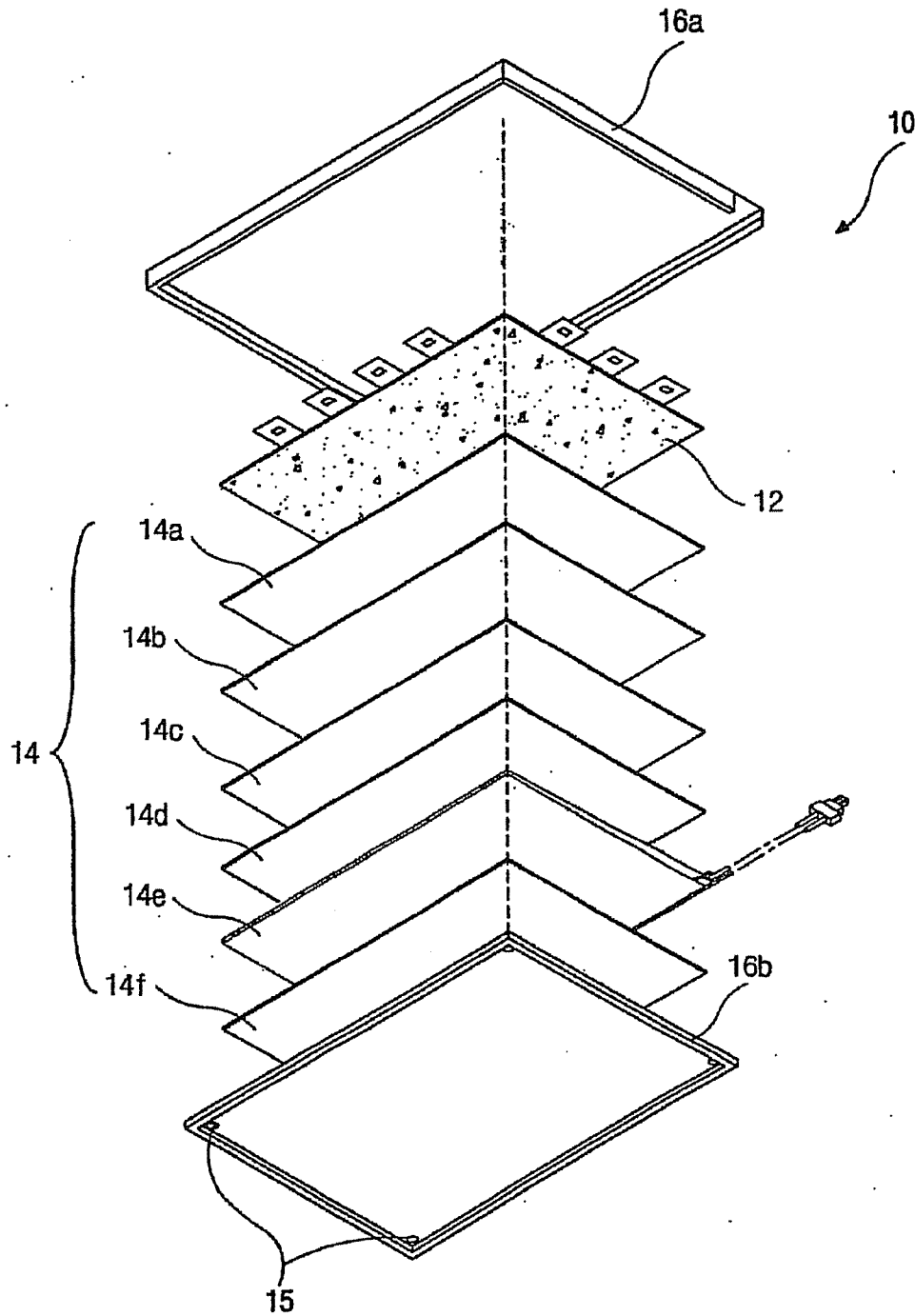
**FIG. 4**

U.S. Patent

Jun. 25, 2002

Sheet 6 of 14

US 6,411,501 B1



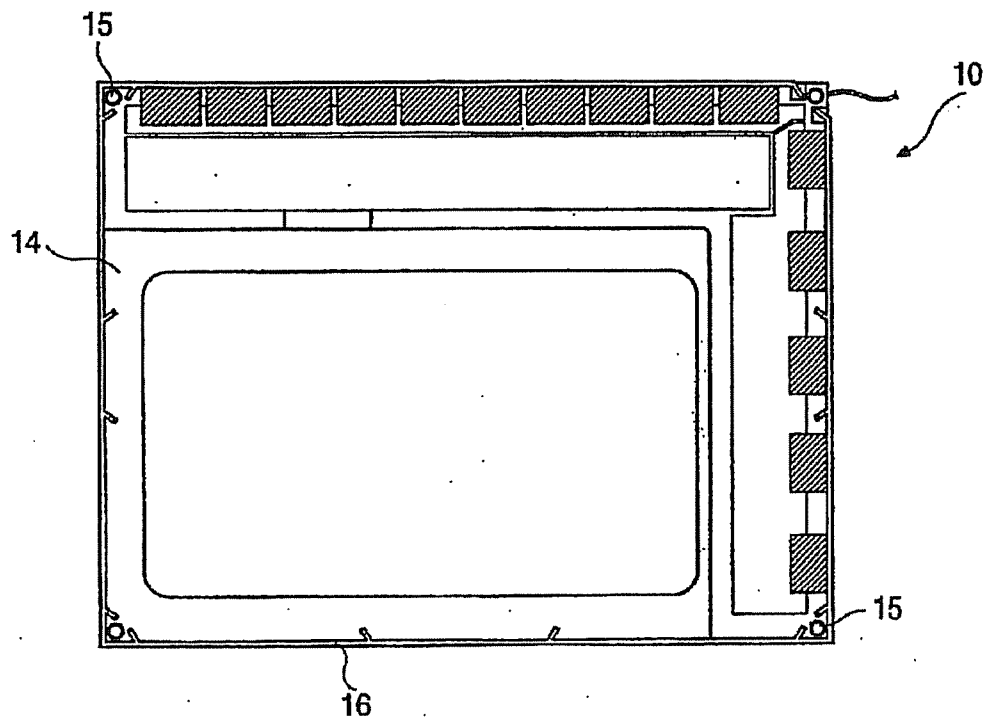
**FIG. 5**

U.S. Patent

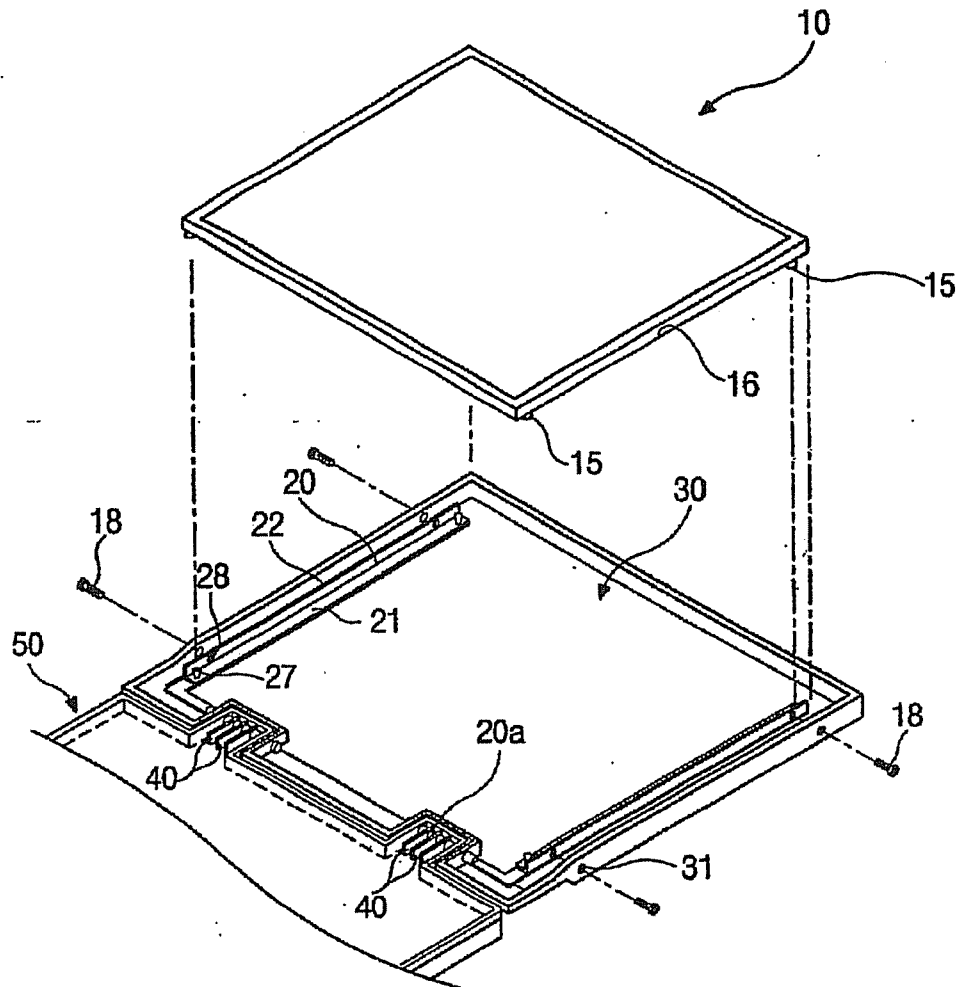
Jun. 25, 2002

Sheet 7 of 14

US 6,411,501 B1



**FIG. 6**



**FIG. 7**

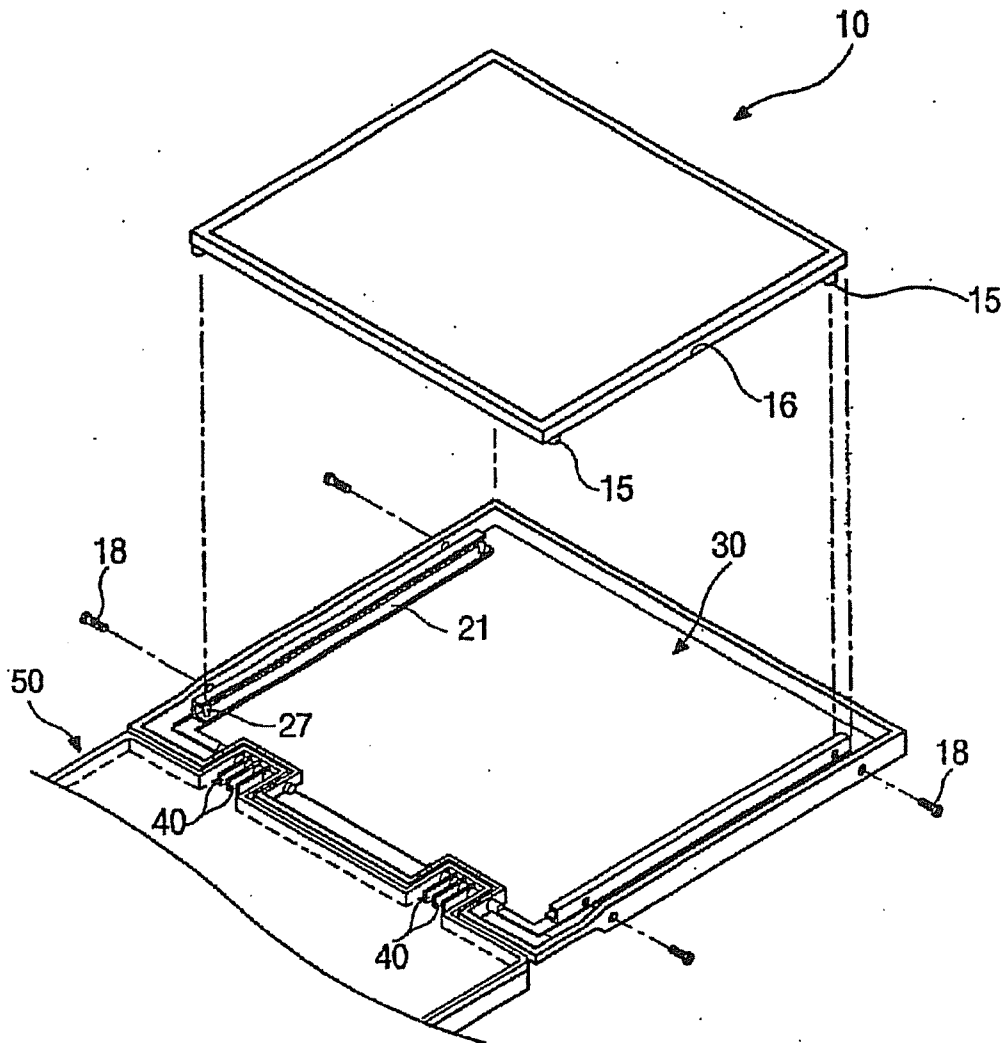


U.S. Patent

Jun. 25, 2002

Sheet 9 of 14

US 6,411,501 B1



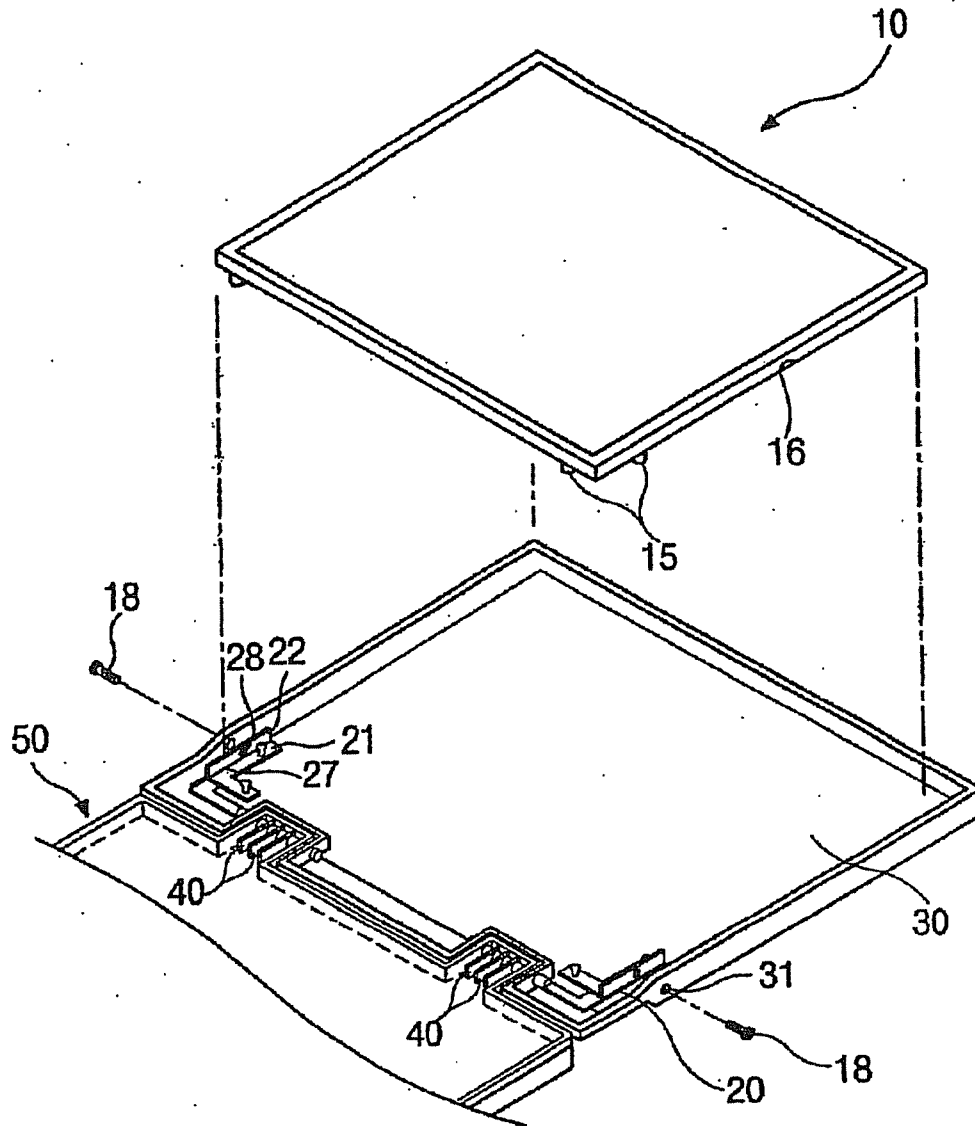
**FIG. 8**

U.S. Patent

Jun. 25, 2002

Sheet 10 of 14

US 6,411,501 B1



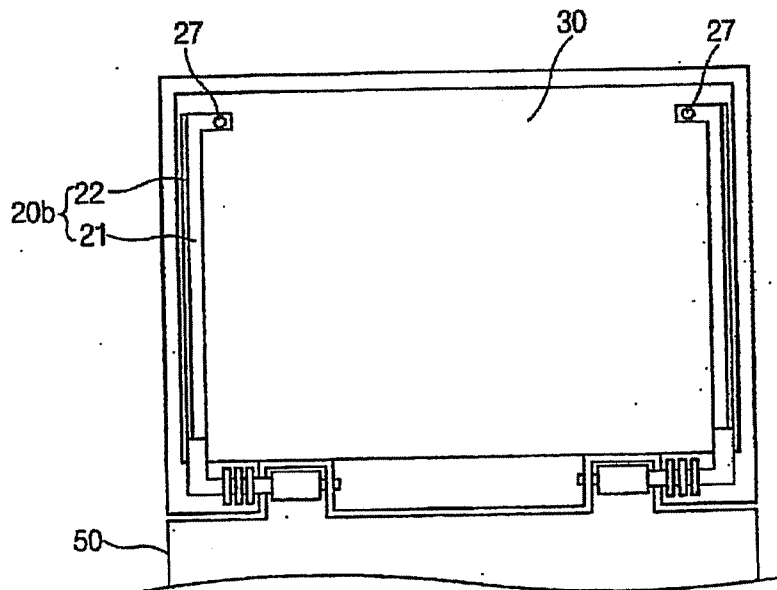
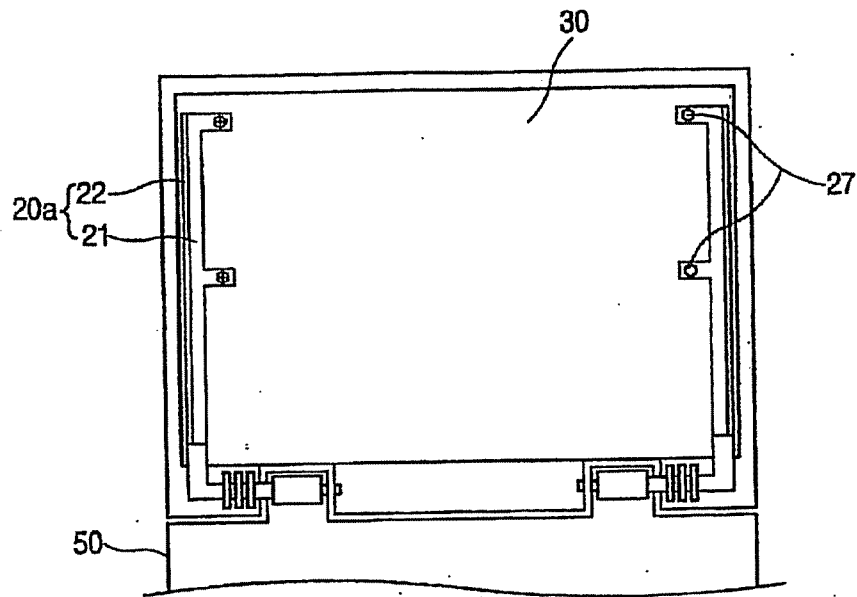
**FIG. 9**

U.S. Patent

Jun. 25, 2002

Sheet 11 of 14

US 6,411,501 B1

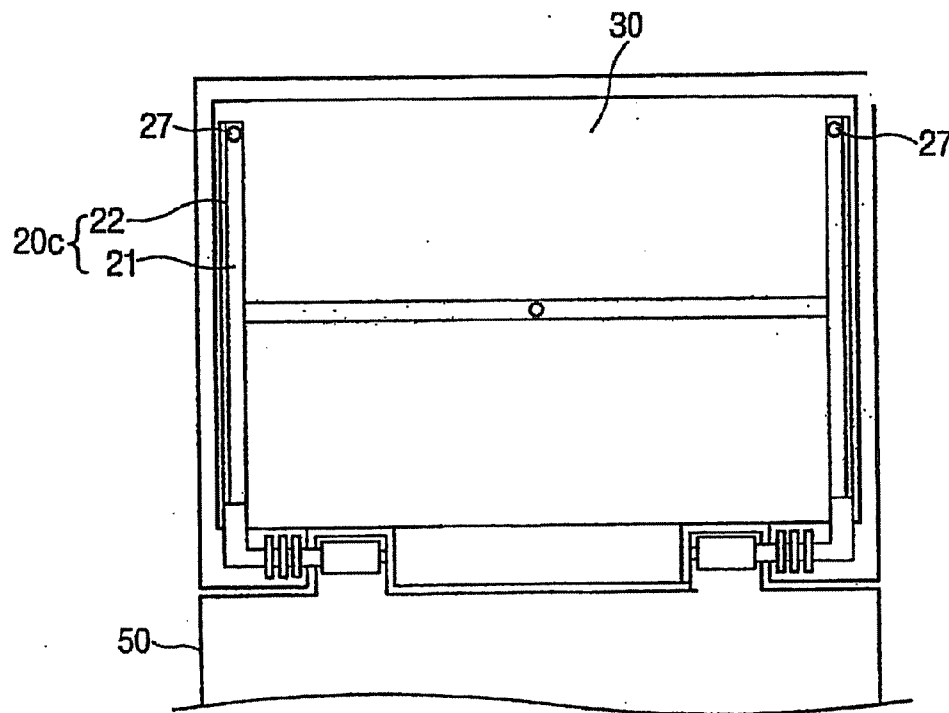


U.S. Patent

Jun. 25, 2002

Sheet 12 of 14

US 6,411,501 B1



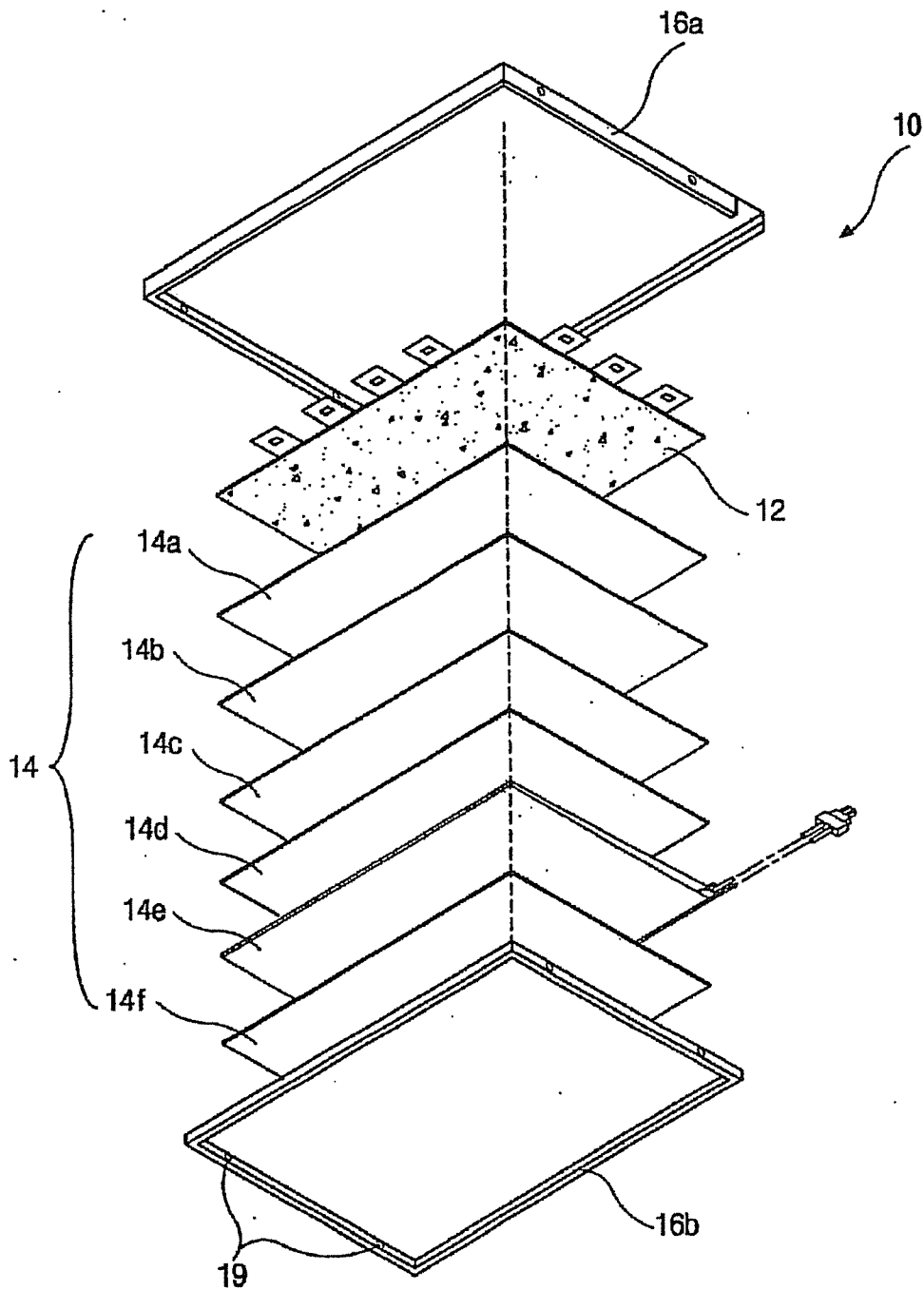
**FIG. 10C**

U.S. Patent

Jun. 25, 2002

Sheet 13 of 14

US 6,411,501 B1



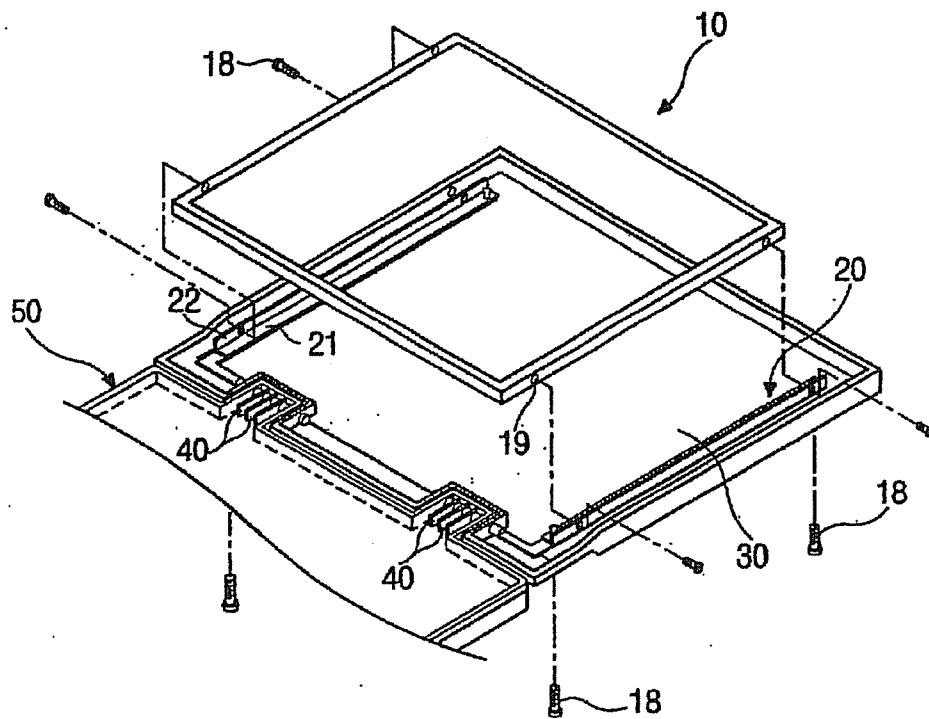
**FIG. 11**

U.S. Patent

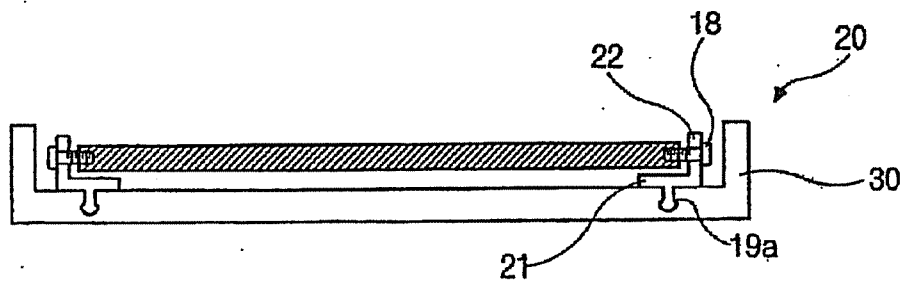
Jun. 25, 2002

Sheet 14 of 14

US 6,411,501 B1



**FIG. 12**



**FIG. 13**

US 6,411,501 B1

1

# PORTABLE COMPUTER AND METHOD FOR MOUNTING A FLAT DISPLAY DEVICE MODULE

This application claims the benefit of Korean Patent Application No. 1998-48265, filed on Nov. 11, 1998, which is hereby incorporated by reference for all purposes as if fully set forth herein.

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates generally to a flat panel display device, and more particularly, to a flat panel display device mounting structure on a computer.

### 2. Description of the Related Art

Flat panel display devices include liquid crystal display (LCD) devices which are used widely, plasma display panels (PDP), and field emission displays (FED) which have been studied recently and may be applied to computers in the near future.

For convenience of explanation, the present invention will be discussed with respect to the LCD as an example of a flat screen type display device and a portable computer mounted with the LCD.

Referring to FIG. 1, a general portable computer such as a laptop or notebook computer typically includes a body 100, a flat panel display device assembly 110 coupled to the body 100 via a hinge mechanism 124. The flat panel display device assembly 110 has a flat panel display module 111 and a display case 122 supporting the module 111. The body 100 has an input device 102 such as a keyboard. As a flat panel display module 111, the LCD is widely used in portable computers and flat screen monitors.

Referring to FIG. 2 which shows a conventional assembly structure of the LCD device applied to a conventional portable computer, the display case 122 has a rear case 123 and a front case or frame 121 for mounting the LCD module 130. The rear case 123 has an outer surface and an inner surface and connecting ribs 123a formed at the corners.

The LCD module 130 has an LCD panel 132, a back light device 134 fixed to the back of the LCD panel 132, and a metal sash or supporting frame 136 for assembling the panel 132 and the back light device 134 along the edge.

At the corners of the metal sash 136, corresponding to the positions of the ribs 123a of the rear case 123, a plurality of protrusions 136a having holes are formed.

For mounting the LCD module 130 to the case 122, the LCD module 130 is placed on the rear case 123 and the holes of the metal sash 136 and the ribs 123a are fastened together preferably by screws 138. The front case 121 is coupled to the rear case 123.

Hereinafter, the way in which the LCD module is mounted to the case from the front toward the rear direction is defined as the front mounting method, and the assembled structure of the LCD module and the case made through the front mounting method is defined as the front mounting structure.

In the front mounting structure of the LCD module 130, since the protrusions 136a require additional space corresponding to the protruded width "d", the ratio of the display area of the LCD module 130 to the fixed size of the case 122 is reduced.

The front mounting structure may also include an additional feature to further support the LCD panel, as shown in FIGS. 3A and 3B.

2

Referring to FIGS. 3A and 3B, a conventional LCD device assembly 110 includes an LCD panel 112, a back light device (not shown) for the LCD panel 112, and a display case 122 supporting an LCD module 111. The LCD panel 112 and the back light device are assembled by a metal sash 114 along the edges together with a plastic mold frame (not shown) supporting the back light device.

The display case 122 is coupled to a body 120 via a hinge mechanism 124, which may form the body 120. The display case 122 and the hinge mechanism 124 allow the LCD device assembly 110 to pivotally move with respect to the body 120.

Two opposite sides of the metal sash 114 include flanges 114a for assembling the LCD module 111 to the display case 122, and flanges 114b for assembling the LCD module 111 to the hinge frame or hinge arm 126. Hereinafter, the former is referred as a fixing flange and the latter is referred as a mounting flange in this specification for distinction purposes. As shown in FIG. 3B, the fixing flanges 114a have a protruding width d2 and the mounting flanges 114b have a protruding width d1. A screw hole is formed in each of the flanges 114a and 114b. On the inner or bottom interior surface of the display case 122, ribs 122a are formed corresponding to the holes of the fixing flange 114a.

To mount the LCD module 111, the hinge frame 126 and the mounting flanges 114b of the metal sash 114 are screwed together, and the fixing flanges 114a of the metal sash 114 and the ribs 122a are screwed together by bolts 128.

In the mounting structure shown in FIG. 3B, the metal sash or support frame 114 requires side spaces for the flanges 114a and 114b. Therefore, the side space D (d1+d2) results in a reduction of the ratio of the display area of the LCD panel 112 relative to the display case 122. Moreover, as the display panel size increases, the display case 122 becomes undesirably large, especially for a portable computer such as a laptop computer.

To solve the above problem, an assembling structure has been suggested, as shown in FIG. 4, which is a partial perspective view. The hinge arm or frame 126, the case 122 and the side wall portion of the display module 110 are screwed together by bolts 128. However, although the embodiment shown in FIG. 4 is a good solution, there may be some instances where it is desired to attach the hinge arm, the case and the side wall portion of the display module without using a screw hole in the side wall portion of the display module or to attach hinge arm with the case (FIG. 3A).

## SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a portable computer that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to minimize the non-display area of the LCD device.

Another object of the present invention is to provide a computer having a flat panel display device with a maximum display area and a minimal display case size.

A further object of the present invention is to provide a firm mounting structure for a flat panel display device on a computer.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages

US 6,411,501 B1

3

tages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and the in accordance with the purpose of the present invention, as embodied and broadly described, the present invention provides, in one aspect, a computer including: a system body having an input device; a display module having a display surface and a rear surface; a display case having a side wall surface; and a hinge pivotally coupling the body to the display module, the hinge including a hinge frame having first and second surfaces, the first surface coupled with the rear surface of the display module, the second surface coupled with the side wall surface of the display case.

In another aspect, the present invention provides a portable computer including: a system body; a display module having a display surface and a side wall surface; a display case having an inner surface; and a hinge pivotally coupling the body to the display case, the hinge including a hinge frame having first and second surfaces, the first surface coupled with the inner surface of the display case, the second surface coupled with the side wall surface of the display module.

In another aspect, the present invention provides a computer including: a system body; a display module having a display surface; a display case having side walls, the display module secured between the side walls of the display case; and a hinge pivotally coupling the body to the display case, the hinge including a hinge frame coupled to the inner surface of the display case.

The present invention according to a first embodiment provides a method for mounting a display module in a portable computer including a system body, a display case having a side wall surface, a hinge having a hinge frame having first and second surfaces, the first surface being substantially parallel to a rear surface of the display module, the second surface being substantially parallel to the side wall surface of the display case, the hinge pivotally coupling the system body to the display case, the method comprising: arranging the hinge frame so that the first surface thereof is positioned between the display case and the rear surface of the display module, and so that the second surface thereof is positioned between the display module and the side wall surface of the display case; fastening the first surface of the hinge frame to the rear surface of the display module; and fastening the second surface of the hinge frame to the side wall surface of the display case.

The present invention according to a second embodiment provides a method for mounting a display module having a side wall surface in a portable computer including a system body, a display case having inner and side wall surfaces, a hinge having a hinge frame having first and second surfaces, the first surface being substantially parallel to a rear surface of the display module, the second surface being substantially parallel to the side wall surface of the display case, the hinge pivotally coupling the system body to the display case, the method comprising: arranging the hinge frame so that the first surface thereof is positioned between the display case and the rear surface of the display module, and so that the second surface thereof is positioned between the display module and the side wall surface of the display case; fastening the first surface of the hinge frame to the inner surface of the display case; and fastening the second surface of the hinge frame to the side wall surface of the display module.

The present invention according to a second embodiment also provides a method for mounting a display module

4

having a side wall surface in a portable computer including a system body, a display case having an inner and two side wall surfaces, a hinge having a hinge frame, the hinge pivotally coupling the system body to the display case, the method comprising: arranging the hinge frame so that a surface thereof is positioned between the inner surface of the display case and the rear surface of the display module; fastening the surface of the hinge frame to the inner surface of the display case; and securing the display module between the side walls of the display case.

Preferably, the display module is a liquid crystal display device (LCD) module.

Preferably, the first and second surfaces of the hinge frame are substantially perpendicular to each other.

Preferably, the first surface of the hinge frame has at least one fixing protrusion protruded toward the rear surface of the display module, and the rear surface of the display module has at least one fixing hole corresponding to the fixing protrusion of the first surface.

Preferably, the fixing protrusion is a fastener.

Preferably, the second surface of the hinge frame is screw-coupled with the side wall surface of the display case.

Preferably, the hinge frame further has a third surface for supporting an edge of the display surface of the display module, and the third surface is substantially perpendicular to the second surface.

Preferably, the fixing protrusion is a fastener.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and are intended to provide further explanation of the invention as claimed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understand of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a perspective view showing a general portable computer;

FIG. 2 shows a structure for mounting an LCD device for a portable computer;

FIGS. 3A and 3B are a perspective view and a front view, respectively, showing a structure for mounting an LCD device for a portable computer;

FIG. 4 is a partial view showing another mounting structure of the LCD device for a conventional portable computer;

FIG. 5 is an exploded perspective view illustrating a structure for mounting a liquid crystal display module of a portable computer according to a first embodiment of the present invention;

FIG. 6 is a bottom view illustrating a rear surface of a liquid crystal display module of a portable computer according to the first embodiment of the present invention;

FIG. 7 is a partially exploded perspective view illustrating a structure for mounting a liquid crystal display module of a portable computer according to a first embodiment of the present invention;

FIG. 8 is a partially exploded perspective view illustrating a modification of a structure for mounting a liquid crystal display module of a portable computer according to a first embodiment of the present invention;



US 6,411,501 B1

5

FIG. 9 is a partially exploded perspective view illustrating another modification of a structure for mounting a liquid crystal display module of a portable computer according to a first embodiment of the present invention;

FIGS. 10A, 10B and 10C are partially exploded perspective views illustrating various modifications of a structure for mounting a liquid crystal display module of a portable computer according to a first embodiment of the present invention

FIG. 11 is an exploded perspective view illustrating a liquid crystal display module according to a second embodiment according to the invention;

FIG. 12 is a partially exploded perspective view illustrating a structure for mounting a liquid crystal display module of a portable computer according to a second embodiment of the present invention; and

FIG. 13 is a partially exploded perspective view illustrating another structure for mounting a liquid crystal display module of a portable computer according to a second embodiment of the present invention.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, an example of which is illustrated in the accompanying drawings.

Referring FIGS. 5 and 6, which show a first embodiment, a display module 10 (which may be a liquid crystal display module) has a display panel 12 and a back light device 14, both of which are assembled to each other by first and second frames 16a and 16b. The back light device 14 comprises a reflective plate 14a, a wave guide plate 14b, a first diffuser/protecting sheet 14c, a first prism sheet 14d, a second prism sheet 14e, and a second diffuser/protecting sheet 14f, which are layered in this order. The display panel 12 and the back light device 14 are supported by first and second frames 16a and 16b, and the second frame 16b has a fixing hole 15. As shown in FIG. 5, a plurality of fixing holes 15 are preferably arranged at each corner of the display module 10. The fixing holes 15 may have the shape of a rib, if necessary.

FIG. 7 is a partially exploded perspective view illustrating structure for mounting a liquid crystal display module of a portable computer according to a first.

A hinge mount 40 is positioned at a protruded portion of a system body 50 such that a display assembly having the display module 10 and the display case 30 pivotally moves with respect to the body 50. A hinge frame 20 is positioned on an inner, or bottom interior, surface of the display case 30. The hinge frame 20 is comprised of a pin portion 20a at its one end, which is inserted into the hinge mount 40, and a "L"-shaped portion 20b which has first and second surfaces 21 and 22. The first surface 21 is parallel to a rear surface of the display module 10, and the second surface 22 is parallel to a side wall surface of the display module 10. The pin portion 20a can be coupled to the L-shaped portion 20b or be integrally formed with the L-shaped portion 20b. The hinge frame 20 also extends along the side wall surface of the display module 10. The first surface 21 has at least one fixing protrusion 27 corresponding to the fixing holes 15 of the rear surface of the display module 10, and the second surface 22 has at least one hole 28 corresponding to the through holes 31 of the side wall surface of the display case 30.

A preferred method for mounting the display module 10 according to the first embodiment is explained hereinafter.

6

The fixing protrusion 27 of the second surface 22 of the L-shaped portion 20b of the hinge frame 20 is inserted into the fixing holes 15 of the display module 10 such that the display module 10 is secured. Then a coupling member 18 such as a screw and a nail passes through the hole 28 of the second surface 22 and the through hole 31 of the display case 30 such that the hinge frame 20 is fixed to the display case 30.

Also, the fixing protrusion 27 preferably has the shape of a plastic hook or a fastener for firmly holding the display module 10, and an inlet portion of the fixing hole 15 is preferably narrower than an interior portion of the fixing hole 15.

To provide a more shockproof and shake-proof mounting structure, the hinge frame 20 can have the shape of "C" as shown in FIG. 8. That is, the hinge frame 20 further has a third surface 23 to support both upper edges of opposing sides of the display module 10 parallel to the hinge frame 20. The first and third surfaces 21 and 23 can be integrally formed with the second surface 22, or can be attachable brackets.

FIG. 9 shows another modification of the first embodiment.

The hinge frame 20 can have a reverse "F" shaped first surface 21 to hold the display module 10, instead of a long elongated first surface 21 (see FIG. 7).

FIGS. 10A, 10B and 10C are other modifications of a mounting structure according to the first embodiment.

The hinge frames 20a, 20b and 20c may have various shapes of first surfaces 21 to enhance a fixing force of a display module 10.

FIG. 11 illustrates a second embodiment, wherein the structure of the display module 10 is similar to that shown in FIG. 5, and therefore, the explanation thereof is not repeated here. However, the display module 10 has a plurality of fixing holes 19 on the side wall surface thereof other than the rear surface thereof. The fixing holes 19 are for a side mounting method wherein the side wall of the display module 10 is coupled to a hinge frame or to the case. That is, the display module 10 can be assembled to the hinge frame 20 (see FIG. 7) not to the case 30 (see FIG. 7). It is also possible that the display module 10 is assembled to the case 30 directly, without engaging the hinge frame 20 therebetween.

FIG. 12 shows an exemplary mounting structure wherein the hinge frame is assembled to the inner, or bottom interior, surface of the case 30 and the display module 10 is mounted inside of the case 30. Preferably, the hinge frame 20 has an "L" shape and has a first surface 21 contacting with the rear surface of display module 10 and a second surface 22 contacting with the side wall surface of the display module 10. The display case 30 has a plurality of screw holes (not shown) on the inner surface thereof, and the first surface 21 of the hinge frame 20 has a plurality of screw holes 25 corresponding to the screw holes of the display case 30. Further, the second surface 21 of the hinge frame 20 preferably has a plurality of screw holes 26 corresponding to the screw holes 19 of the side wall surface of the display module 10. Thus, the first surface 21 of the hinge frame 20 is coupled with the display case 30, and the second surface 22 of the hinge frame 20 is coupled with the display module 10.

FIG. 13 shows another exemplary mounting structure of the second embodiment. The structure of FIG. 13 also shows a mounting structure wherein the hinge frame 20 is assembled to the inner surface of the case 30.

US 6,411,501 B1

7

The first surface 21 of the hinge frame 20 has a plurality of plastic hooks or fasteners protruded toward the inner surface of the case 30, and the display case 30 has a plurality of fastener fixing holes 19a corresponding to the fastener, thereby the first surface 21 of the hinge frame 20 is coupled with the display case 30 by pressing the first surface 21 without tightening a screw.

In the second embodiment, instead of a screw and fastener, a nail can be employed. Further, the hinge frame may be "C" shaped, and a bracket having a long length may be used instead of the hinge frame integrally formed with the pin portion. The hinge frame may have a short length.

As described until here, using the mounting structure according to the invention, the display area is maximized, and a more shock-proof display assembly is provided. Further, the mounting structure according to one embodiment of the invention has an advantage that the display assembly can be assembled to the case without tightening a screw into the side wall surface of the display module. The invention also shows that the hinge frame of the invention can be assembled to a rear surface of the display module or to an inner surface of the case.

Other embodiments of the invention will be apparent to the skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with the true scope and spirit of the invention being indicated by the following claims.

What is claimed is:

1. A portable computer, comprising:
  - a system body having an input device;
  - a display module having a display surface and a rear surface;
  - a display case having a side wall surface; and
  - a hinge pivotally coupling the system body to the display module, the hinge including a hinge frame having first and second surfaces, the first surface coupled with the rear surface of the display module, the second surface coupled with the side wall surface of the display case.
2. The computer of claim 1, wherein the display module is a liquid crystal display (LCD) module.
3. The computer of claim 2, wherein the first and second surfaces of the hinge frame are substantially perpendicular to each other.
4. The computer of claim 2, wherein the first surface of the hinge frame has at least one fixing protrusion protruded toward the rear surface of the display module, and the rear surface of the display module has at least one fixing hole corresponding to the fixing protrusion of the first surface.
5. The computer of claim 4, wherein the fixing protrusion is a fastener.
6. The computer of claim 4, wherein the second surface of the hinge frame is screw-coupled with the side wall surface of the display case.
7. The computer of claim 2, wherein the hinge frame further has a third surface for supporting an edge of the display surface of the display module, and the third surface is substantially perpendicular to the second surface.
8. A portable computer, comprising:
  - a system body;
  - a display module having a display surface and a side wall surface;
  - a display case having an inner surface; and
  - a hinge pivotally coupling the system body to the display case, the hinge including a hinge frame having first and

8

second surfaces, the first surface coupled with the inner surface of the display case, the second surface coupled with the side wall surface of the display module.

9. The computer of claim 8, wherein the display module is a liquid crystal display (LCD) module.

10. The computer of claim 9, wherein the first surface of the hinge frame is screw-coupled with the inner surface of the display case, and the second surface of the hinge frame is screwcoupled with the side wall surface of the display module.

11. The computer of claim 9, wherein the first surface of the hinge frame has at least one fixing protrusion protruded toward the inner surface of the display case, and the inner surface has at least one fixing hole corresponding to the fixing protrusion of the first surface.

12. The computer of claim 11, wherein the fixing protrusion is a fastener.

13. A computer, comprising:

- a system body;
- a display module having a display surface;
- a display case having side walls, the display module secured between the side walls of the display case; and
- a hinge pivotally coupling the body to the display case, the hinge including a hinge frame coupled to the inner surface of the display case.

14. The computer of claim 13, wherein the display module is a liquid crystal display (LCD) module.

15. The computer of claim 14, wherein the hinge frame is screw-coupled with the inner surface of the display case.

16. The computer of claim 14, wherein the hinge frame has at least one fixing protrusion protruded toward the inner surface of the display case, and the inner surface has at least one fixing hole corresponding to the fixing protrusion of the hinge frame.

17. The computer of claim 16, wherein the fixing protrusion is a fastener.

18. A method for mounting a display module in a portable computer including a system body, a display case having a side wall surface, a hinge having a hinge frame having first and second surfaces, the first surface being substantially parallel to a rear surface of the display module, the second surface being substantially parallel to the side wall surface of the display case, the hinge pivotally coupling the system body to the display case, the method comprising:

- arranging the hinge frame so that the first surface thereof is positioned between the display case and the rear surface of the display module, and so that the second surface thereof is positioned between the display module and the side wall surface of the display case;
- fastening the first surface of the hinge frame to the rear surface of the display module; and
- fastening the second surface of the hinge frame to the side wall surface of the display case.

19. The method of claim 18, wherein the display module is a liquid crystal display (LCD) module.

20. The method of claim 18, wherein the first surface of the hinge frame has at least one fixing protrusion protruded toward the rear surface of the display module, and the rear surface of the display module has at least one fixing hole corresponding to the fixing protrusion of the first surface of the hinge frame.

21. The method of claim 18, wherein the first surface of the hinge frame is screw-coupled with the rear surface of the display module.

22. The method of claim 18, wherein the second surface of the hinge frame is screw-coupled with the side wall surface of the display case.

## US 6,411,501 B1

9

23. A method for mounting a display module having a side wall surface in a portable computer including a system body, a display case having inner and side wall surfaces, a hinge having a hinge frame having first and second surfaces, the first surface being substantially parallel to a rear surface of the display module, the second surface being substantially parallel to the side wall surface of the display case, the hinge pivotally coupling the system body to the display case, the method comprising:

arranging the hinge frame so that the first surface thereof is positioned between the display case and the rear surface of the display module, and so that the second surface thereof is positioned between the display module and the side wall surface of the display case; fastening the first surface of the hinge frame to the inner surface of the display case; and fastening the second surface of the hinge frame to the side wall surface of the display module.

24. The method of claim 23, wherein the display module is a liquid crystal display (LCD) module.

25. The method of claim 23, wherein the first surface of the hinge frame is screw-coupled with the inner surface of the display case.

26. The method of claim 23, wherein the second surface of the hinge frame is screw-coupled with the side wall surface of the display module.

10

27. The method of claim 23, wherein the first surface of the hinge frame is coupled to the inner surface of the display case by a fastener.

28. A method for mounting a display module having a side wall surface in a portable computer including a system body, a display case having an inner and two side wall surfaces, a hinge having a hinge frame, the hinge pivotally coupling the system body to the display case, the method comprising:

arranging the hinge frame so that a surface thereof is positioned between the inner surface of the display case and the rear surface of the display module;

fastening the surface of the hinge frame to the inner surface of the display case; and

securing the display module between the side walls of the display case.

29. The method of claim 28, wherein the display module is a liquid crystal display (LCD) module.

30. The method of claim 28, wherein the surface of the hinge frame is screw-coupled with the inner surface of the display case.

31. The method of claim 28, wherein the surface of the hinge frame is coupled to the inner surface of the display case by a fastener.

\* \* \* \* \*

# EXHIBIT 24

US005379182A

# United States Patent [19]

Fujimori et al.

[11] Patent Number: **5,379,182**

[45] Date of Patent: **Jan. 3, 1995**

[54] **HINGED DISPLAY PANEL WITH OUTER COVER AND DISPLAY PANEL UNIT SEPARATELY CONNECTED TO AN INNER COVER AND INFORMATION MACHINE INCLUDING THE SAME**

[75] Inventors: **Hideaki Fujimori, Tokyo; Tetsu Ishikawa, Tochigi; Yoshihisa Tamura, Gunma; Minoru Imaizumi, Saitama, all of Japan**

[73] Assignees: **NEC Corporation, Tokyo; Sanyo Electric Co., Ltd., Moriguchi, both of Japan**

[21] Appl. No.: **980,190**

[22] Filed: **Nov. 23, 1992**

## [30] Foreign Application Priority Data

Nov. 29, 1991 [JP] Japan ..... 3-098391[U]  
Nov. 29, 1991 [JP] Japan ..... 3-315086  
Nov. 29, 1991 [JP] Japan ..... 3-315088

[51] Int. Cl.<sup>6</sup> ..... **H05K 5/03; G06F 1/16**

[52] U.S. Cl. .... **361/681; 292/8; 292/56**

[58] Field of Search ..... **364/708.1; 345/169, 345/905; 359/83; 361/680-682; 70/58; 248/917-923; 312/223.2, 208.4; 292/8, 11, 32, 56, 99**

## [56] References Cited

### U.S. PATENT DOCUMENTS

5,109,570 5/1992 Okada et al. .... 16/289  
5,229,757 7/1993 Takamiya et al. .... 361/681 X

### FOREIGN PATENT DOCUMENTS

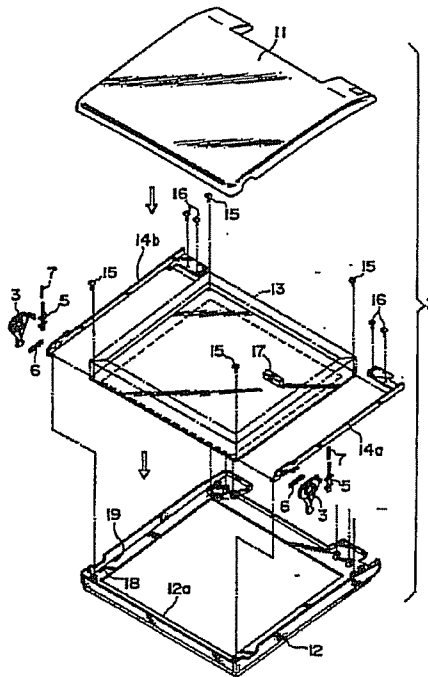
200407 12/1986 European Pat. Off. .... 359/83  
62-257512 11/1987 Japan .  
64-78312 3/1989 Japan .  
64-54125 4/1989 Japan ..... G06F 1/00  
1-76622 5/1989 Japan .  
2-119723 9/1990 Japan .

*Primary Examiner*—Michael W. Phillips  
*Attorney, Agent, or Firm*—Armstrong, Westerman, Hattori, McLeland & Naughton

## [57] ABSTRACT

A display panel and an information machine including the display panel, include a display panel unit having a display screen, and an inner cover for covering the inside of the display panel unit. A pair of metal fittings are screwed to side end portions of the display panel unit. In addition, an outer cover is provided for covering the outside of the display panel unit, where the outer cover and the display panel unit are both separately connected to the inner cover, so that the outer cover can be removed while leaving the display panel unit attached to the inner cover. Since the entire back surface of the display panel unit is exposed merely by removing the outer cover, the inspection and repair of the display panel unit is facilitated.

**16 Claims, 9 Drawing Sheets**



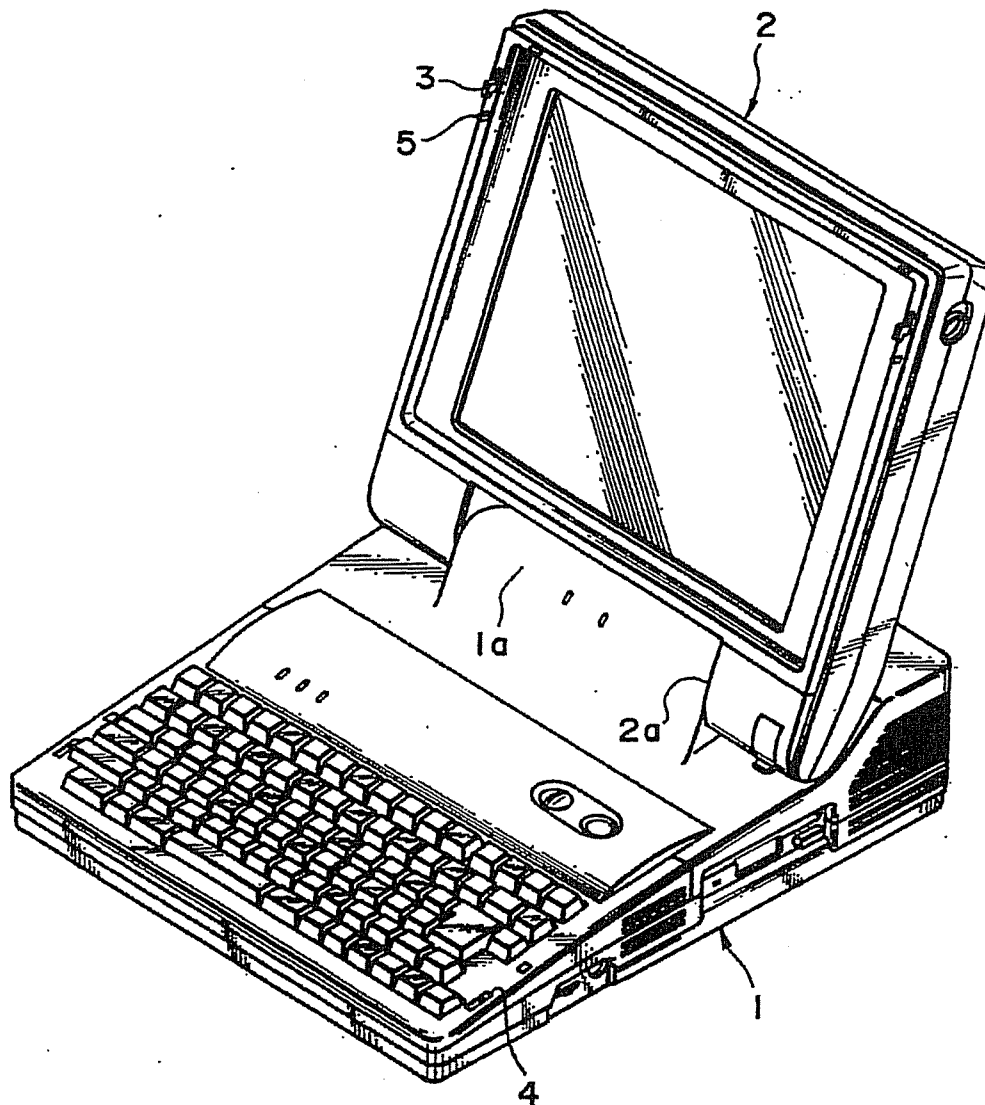
U.S. Patent

Jan. 3, 1995

Sheet 1 of 9

5,379,182

FIG. 1





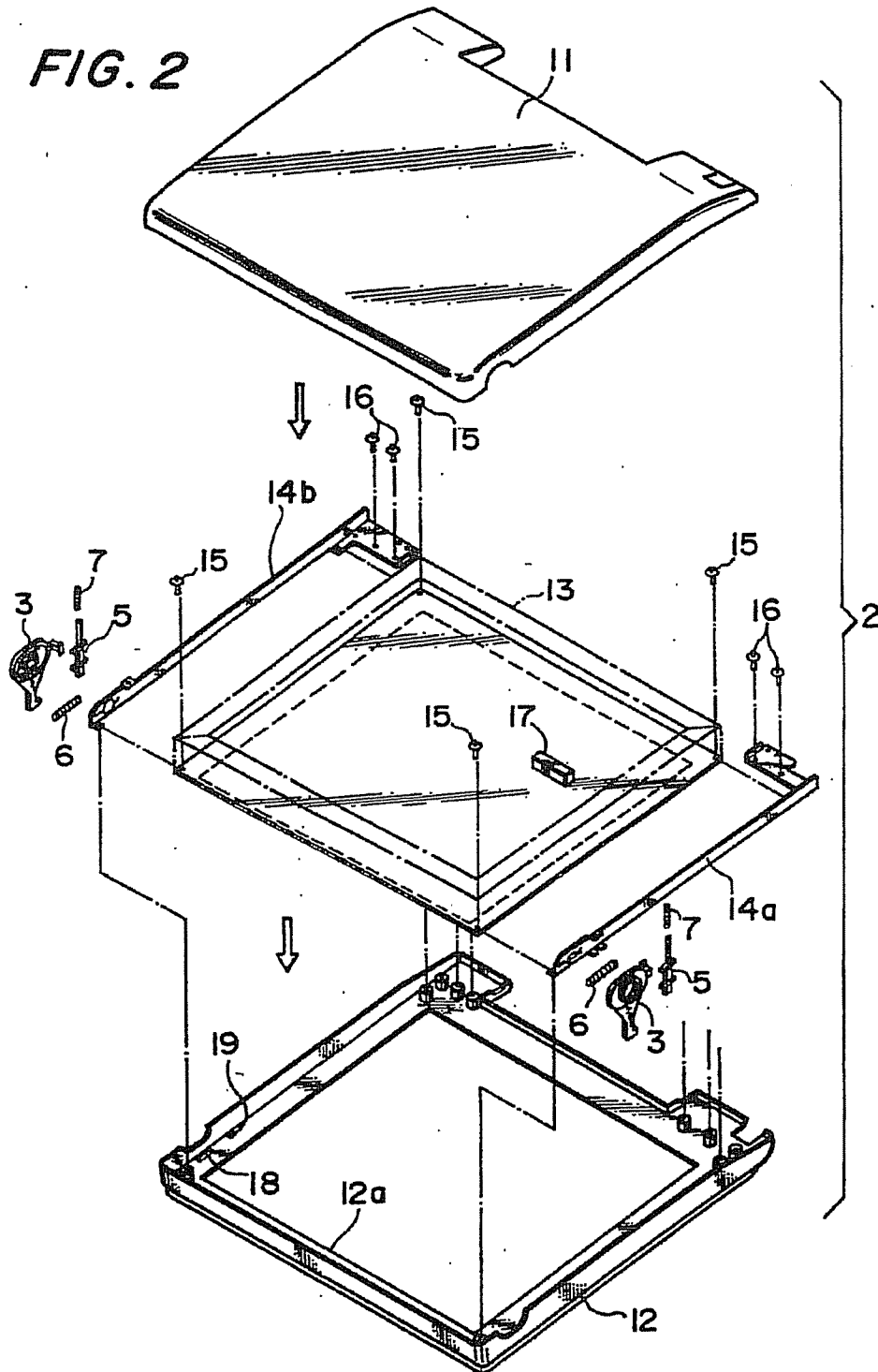
U.S. Patent

Jan. 3, 1995

Sheet 2 of 9

5,379,182

FIG. 2



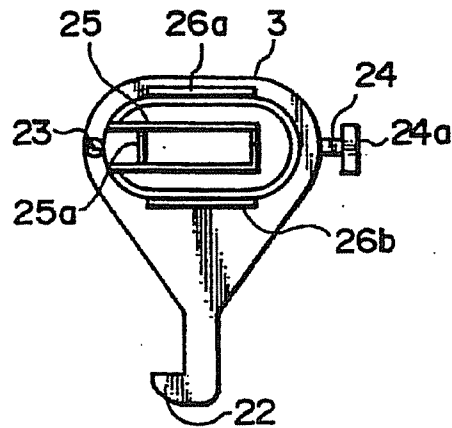
U.S. Patent

Jan. 3, 1995

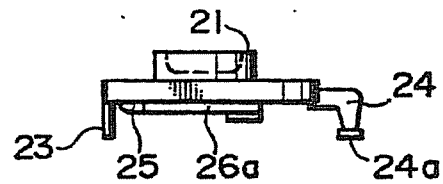
Sheet 3 of 9

5,379,182

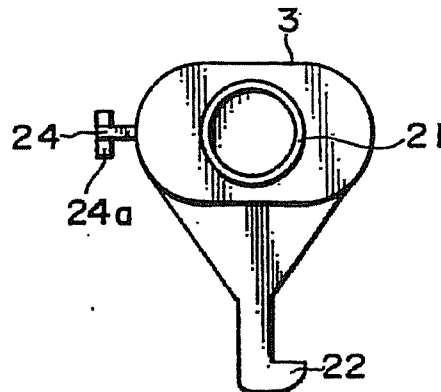
*FIG. 3A*



*FIG. 3B*



*FIG. 3C*





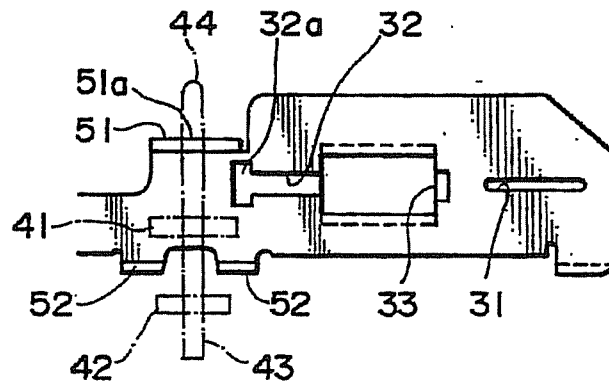
U.S. Patent

Jan. 3, 1995

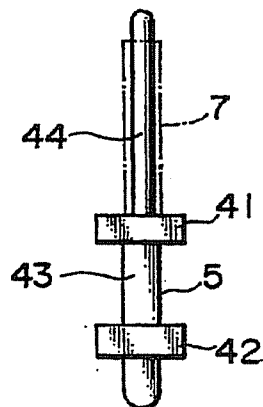
Sheet 4 of 9

5,379,182

*FIG. 4*



*FIG. 5*



U.S. Patent

Jan. 3, 1995

Sheet 5 of 9

5,379,182

FIG. 6A

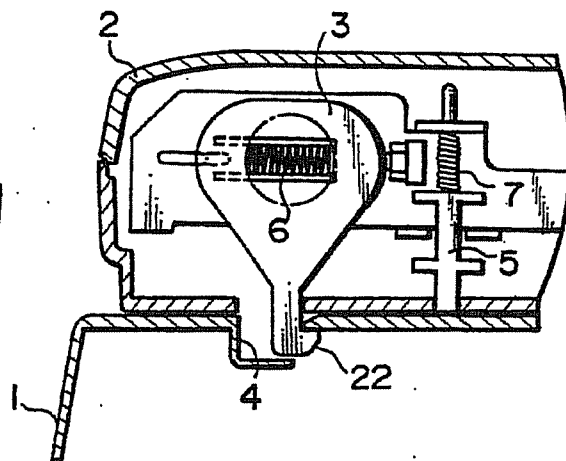


FIG. 6B

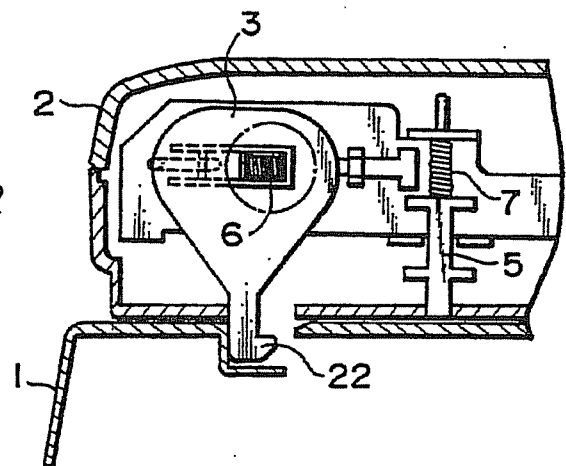
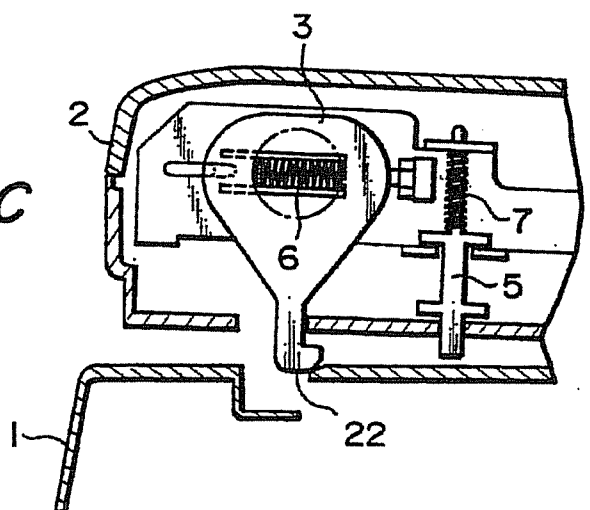


FIG. 6C



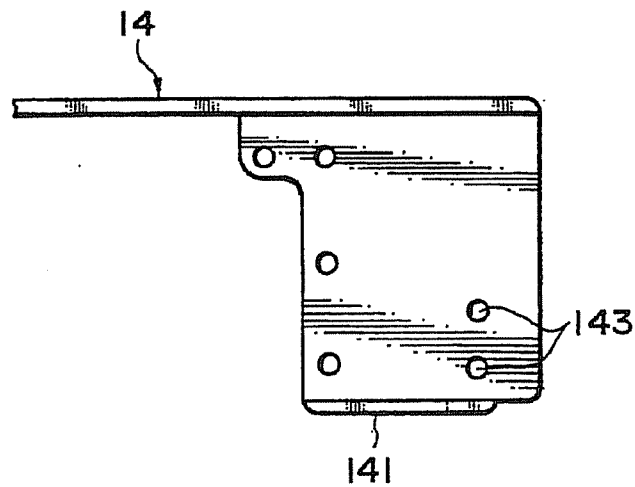
U.S. Patent

Jan. 3, 1995

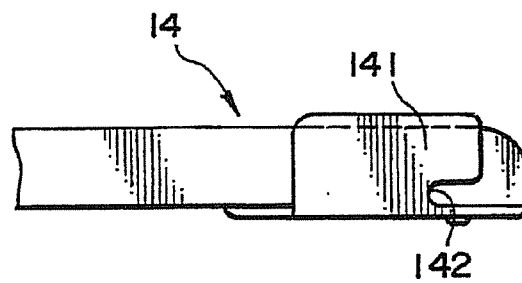
Sheet 6 of 9

5,379,182

*FIG. 7A*



*FIG. 7B*



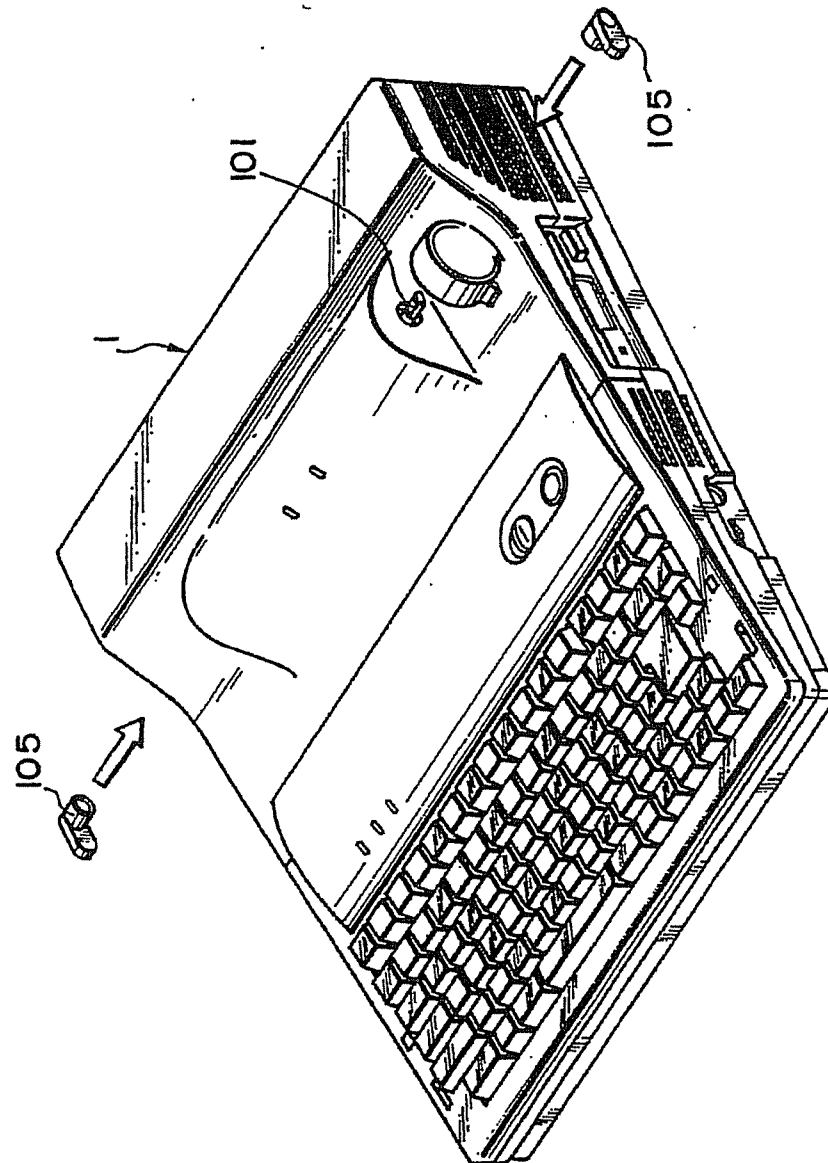
U.S. Patent

Jan. 3, 1995

Sheet 7 of 9

5,379,182

FIG. 8



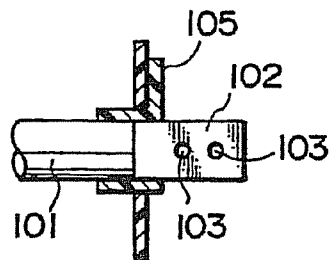
U.S. Patent

Jan. 3, 1995

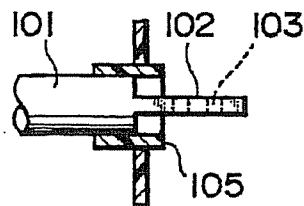
Sheet 8 of 9

5,379,182

*FIG. 9A*



*FIG. 9B*



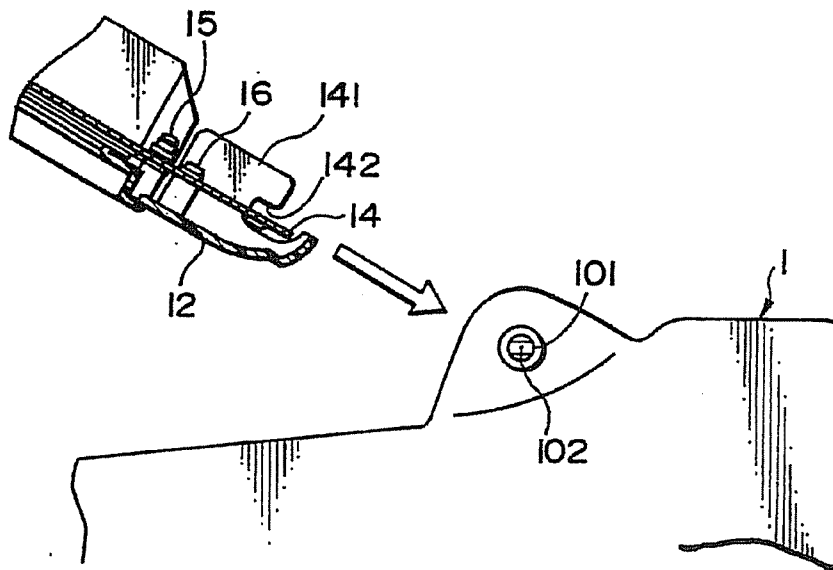
U.S. Patent

Jan. 3, 1995

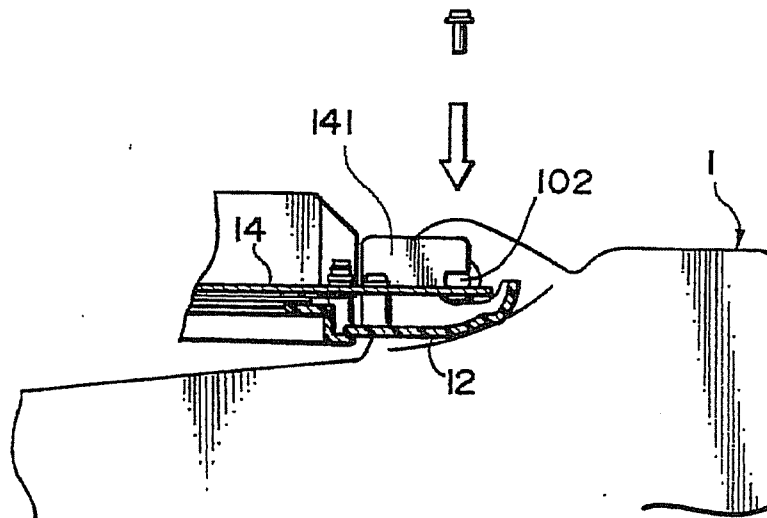
Sheet 9 of 9

5,379,182

*FIG. 10A*



*FIG. 10B*



5,379,182

1

# HINGED DISPLAY PANEL WITH OUTER COVER AND DISPLAY PANEL UNIT SEPARATELY CONNECTED TO AN INNER COVER AND INFORMATION MACHINE INCLUDING THE SAME

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to the structure of a display panel such as a liquid crystal display (hereinafter referred to as "LCD") which is pivotably supported by the main body of an information machine such as a personal computer or a word processor.

### 2. Description of the Related Art

Personal computers, word processors, etc. which are provided with a liquid crystal panel as the display unit are widely used. Especially, lap-top or portable information machines adopt a liquid crystal panel. In such an apparatus, the liquid crystal panel is made pivotable. When the liquid crystal panel is not used, it functions as a lid of the apparatus, thereby protecting the display surface and preventing the ingress of dust or the like. When the liquid crystal panel is used, it is set up so that the operator can operate the keyboard, etc. while watching the display surface.

The liquid crystal panel is composed of an LCD unit for actually displaying data, and an inner cover and an outer cover which constitute a case for accommodating the LCD unit. A large opening for exposing the display surface of the LCD unit is provided on the inner cover so that the operator can see the display surface of the LCD unit during use.

Provision of such a large opening on the inner cover greatly reduces the rigidity of the inner cover. Since the cover is generally made of a plastic material such as an ABS resin, the mechanical strength of the cover is greatly reduced if a large opening is provided thereon. To solve this problem, the LCD unit is attached to the outer cover which has no opening for exposing the display surface of the LCD unit in a conventional crystal liquid panel.

At the time of checkout or repair of such an apparatus with the LCD unit attached to the outer cover, the inner cover is first removed. However, the portion of the LCD unit which is exposed after the inner cover is removed is only a small portion around the display surface, so that the LCD unit must be removed from the outer cover in order to actually check out or repair the apparatus. Thus, there is a problem in the operability of the apparatus. In addition, in many apparatuses, the inner cover is provided with an operation switch and a locking mechanism, so that it is not easy to remove the inner cover itself.

The structure for attaching an LCD unit is described in, for example, Japanese Patent Laid-Open No. Sho 62-257512.

In order to pivotably fix a liquid crystal panel to the main body of a computer, a hinging mechanism is necessary. A liquid crystal panel is generally screwed to a rotary shaft provided on the main body. Such a hinging mechanism is described in, for example, Japanese Patent Laid-Open No. Sho 62-257512 and Japanese Utility Model Laid-Open No. Hei 1-76622.

In a general structure for attaching a liquid crystal panel, metal fittings are first fixed to a rotary shaft, and thereafter fixed again to the liquid crystal panel. According to this conventional method, positioning of the

2

metal fittings, which is difficult, is required twice, so that the operability is deteriorated. Especially in the case of cutting the lower end of the liquid crystal panel in a shade of a gate in such a manner as to surround the rotary shaft attached to the main body in order to make the connecting portion good to look at, it is impossible to connect the liquid crystal panel with the rotary shaft by screwing from the outside, so that the assembly of the apparatus such as attachment of metal fittings is difficult.

When the outer cover of the liquid crystal panel is functioned as a lid of the apparatus, the liquid crystal panel is locked to the main body so that the liquid crystal panel is safe even while it is carried. In order to lock the liquid crystal panel, a locking claw is provided on a part of the liquid crystal panel and the claw is engaged with a hole or the like in the main body. Such a locking device is described in, for example, Japanese Patent Laid-Open No. Sho 64-78312.

In a conventional locking device, a hooking member for locking the liquid crystal panel to the main body is urged toward the locking position by a coil spring or the like, and when the locking operation is released, the hooking member is shifted to the unlocking position with a finger or the like. The coil spring for urging the hooking member either pulls the hooking member from the outside, or pushes the hooking member from the opposite side.

In such a locking device, since the coil spring is disposed in the vicinity of the hooking member, the space for accommodating the spring is necessary, which is an obstacle to the reduction of the size of the apparatus. In addition, in assembling the apparatus, it is necessary to combine the coil spring with one end thereof fixed to the liquid crystal panel to the hooking member, which makes the assembly difficult.

## SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to eliminate the above-described problems in the related art and to provide a display panel which is easy to assemble and which shows a good operability at the time of checkout or repair.

It is another object of the present invention to provide a locking mechanism for a display panel which enables a reduction in size of an information machine as a whole and facilitates the assembly of the machine.

It is still another object of the present invention to provide a structure for attaching a display panel to the main body of an information machine which facilitates the assembly of the apparatus and which provides an adequate mechanical strength for the display panel.

To achieve this aim, the present invention provides a display panel which is pivotably attached to the main body of an information machine so as to display various data, the display panel comprising:

a display panel unit including a display screen and a driving circuit; and

a pair of metal fittings which are screwed to both side end portions of the display panel unit so as to be rotatably supported by the main body of the machine.

The display panel further comprises:

an outer cover for covering the outside of the display unit; and

an inner cover for covering the inside of the display unit, the inner cover being provided with an open-

5,379,182

3

ing for exposing the display portion of the display unit at the position corresponding to the display portion.

The inner cover is screwed to the display unit.

The inner cover may be screwed to the display unit together with the metal fittings.

According to this display panel, the display panel is accommodated in an inner cover. Consequently, it is possible to expose the entire part of the back side of the display unit merely by removing an outer cover, so that the operability is good at the time of checkout or repair. What is to be done in attaching the display unit to the main body is only to attach the inner cover to which the display unit is attached to the main body of the machine, and thereafter to attach the outer cover to the inner cover. Assembly of the machine is thus very easy. In addition, since the display unit is attached to the inner cover through metal fittings, an adequate mechanical strength of the inner cover is maintained.

The main body of the machine has a rotary shaft provided with a plate portion on both ends thereof and each of the pair of metal fittings may have a notch into which the plate portion of the rotary shaft is inserted and a hole through which the metal fitting is screwed to the rotary shaft. The metal fittings are screwed to the rotary shaft which is inserted into the notches.

According to this structure, the plate portions provided on the rotary shaft which protrudes from the main body of the information machine are positioned at the respective notches of the metal fittings. In this state, the plate portions are pushed into the notches. By this operation, the plate portions are held by the notches, so that it is very easy to screw the metal fittings to the rotary shaft through the holes.

The metal fitting has a first portion which is disposed along the side end portion of the display unit, a second portion which extends toward the inside of the display unit orthogonally to the first portion, and a third portion which extends toward the other end of the second portion orthogonally to the second portion. The notch is provided on the third portion and the hole through which the metal fitting is screwed to the rotary shaft is provided in the second portion. A hole through which the metal fitting is screwed to the display unit is also provided in the second portion.

The metal fitting of the display panel of the present invention includes:

- a hooking member which is longitudinally slidably held by the corresponding metal fitting and protrudes from the display panel toward the main body of the machine;
- a claw portion provided at the protruding end of the hooking member so as to engage a hole which is provided in the main body of the machine and to lock the display panel to the main body;
- a box-shaped spring container which is provided on the hooking member on the side facing the display panel so as to accommodate a coil spring therein; and
- a projection piece provided on the metal fitting so as to compress the coil spring in the spring container and urge the hooking member in one direction.

According to this structure, the coil spring is compressed by the projection piece provided on the metal fitting. It is therefore possible to urge the hooking member in one direction by the coil spring, and lock the display panel to the main body in the state in which the lower ends of the hooking members are inserted to the

4

holes provided in the main body of the machine for this purpose. In the case of releasing the locking operation, the operator can easily unlock the display panel and the main body by manually shifting the hooking members. Since the coil spring is accommodated in the box-shaped spring container, reduction of the size of the locking device as a whole is possible. In addition, since the coil spring is accommodated in the box-shaped spring container, it is possible to assemble the locking device merely by engaging the coil spring with the projection piece in this state, thus greatly facilitating the assembly of the apparatus.

The hooking member is composed of a plate-like material and is provided with a protuberance on the opposite side to the box-shaped spring container so as to facilitate the movement of the hooking member with the operator's finger.

The metal fitting is provided with a slot having a predetermined size, and the hooking member is provided with a projection which is inserted into the slot so that the hooking member is slidably held by the metal fitting.

The metal fitting holds an unlocking member which protrudes out of the display panel toward the main body of the machine. The unlocking member is urged toward the main body of the machine by a spring.

An information machine according to the present invention having the main body of the machine provided therein with a keyboard, a computer and the like, and a display panel which is pivotably attached to the main body of the information machine so as to display various data is characterized by the display panel including:

- a display panel unit provided with a display unit screen and a driving circuit; and
- a pair of metal fittings which are screwed to both side end portions of the display panel unit so as to be rotatably supported by the main body of the machine.

The above and other objects, features and advantages of the present invention will become clear from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective external view of a computer incorporating an embodiment of a display panel according to the present invention;

FIG. 2 is an explanatory exploded view of the structure of the embodiment shown in FIG. 1;

FIGS. 3A to 3C show the structure of a hooking member used in the embodiment, wherein 3A is one side view, 3B is a plan view and 3C is the other side view;

FIG. 4 shows the structure of the end portion of a metal fitting used in the embodiment;

FIG. 5 shows the structure of an unlocking member used in the embodiment;

FIGS. 6A, 6B and 6C are explanatory views of the locking operation of the embodiment;

FIGS. 7A and 7B show the structure of the main part of the metal fitting;

FIG. 8 is an explanatory perspective view of a shaft attached to the main body of the computer;

FIGS. 9A and 9B show the structure of the end portion of the shaft shown in FIG. 8; and

FIGS. 10A and 10B are explanatory views of the process for attaching the shaft to the main body.



5

5,379,182

6

### DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will be explained hereinafter with reference to the accompanying drawings.

#### Entire Structure

FIG. 1 is a perspective external view of a lap-top computer as an information machine which incorporates an embodiment of a display panel according to the present invention. The lap-top computer is composed of a computer body 1 provided therein with a CPU, an HDD, an FDD, etc. and a liquid crystal panel 2 as a display panel having a display portion. The liquid crystal panel 2 has a notched portion 2a at the lower end thereof, and the liquid crystal panel 2 is pivotably supported at the notched portion 2a by a bulgy portion 1a of the computer body 1. In FIG. 1, the liquid crystal panel 2 is set up. In this state, the operator turns on the switch and operates the keyboard and the like while watching the display portion. When the computer is not used, the liquid crystal panel 2 is rotated toward the computer body 1 so as to cover the upper surface of the computer body 1 with the liquid crystal panel 2.

#### Liquid Crystal Panel

The structure of the liquid crystal panel 2 will now be explained with reference to FIG. 2. FIG. 2 shows the process for assembling the liquid crystal panel 2. The liquid crystal panel 2 has an outer cover 11 and an inner cover 12 which corresponds to the outer cover 11. By combining these covers 11, 12, the shell of the liquid crystal panel 2 is produced. An LCD unit 13 is accommodated in this shell as a display unit having a liquid crystal display portion for displaying various data. The LCD unit 13 is screwed to the inner cover 12 together with a pair of metal fittings 14a, 14b by four screws 15. The metal fittings 14a, 14b are further screwed to the inner cover 12 by four screws 16. In this way, both side ends of the LCD unit 13 are fixed to the metal fittings 14a, 14b and reinforced thereby. The metal fittings 14a, 14b reinforce the inner cover 12.

In assembling the liquid crystal panel 2, after the LCD unit 13 is attached to the inner cover 12 together with the metal fittings 14a, 14b, the outer cover 11 is attached to the inner cover 12 by an appropriate means. For example, hooks (not shown) which engage the end portions of the inner cover 12 are provided at the end portions of the outer cover 11, and the inner cover 12 is screwed to the outer cover 11 at several points. According to this embodiment, it is possible to see the back surface of the LCD unit 13 in the state in which the outer cover 11 is removed, thereby facilitating the checkout or the like of the LCD unit 13. A connector 17 for electrically connecting the LCD unit 13 with the computer body 1 is provided on the back surface of the LCD unit 13. Therefore, simply by removing the outer cover 11, disconnection between the LCD unit 13 and the computer body 1 through the connector 17 is facilitated and the removal of the LCD unit 13 is also facilitated.

Most of the inner cover 12 constitutes an opening 12a for exposing the display surface of the LCD unit 13 so that the mechanical strength of the inner cover 12 is low, but since the inner cover 12 is reinforced by the metal fittings 14a, 14b, it is possible to accommodate and hold the LCD unit 13 with high reliability.

If the LCD unit 13 used has a high resolution, the weight of the LCD unit 13 increases. If the weight of the LCD unit 13 is as heavy as about 2 kg, for example, a steel plate of about 2 mm thick is used as the metal fittings 14a and 14b.

#### Locking Mechanism

A hooking member 3 is provided within both side end portions of the liquid crystal panel 2, and the end portion of the hooking member 3 is inserted into a hook receiver 4 provided at the corresponding portion of the computer body 1, so that the liquid crystal panel 2 is locked to the computer body 1 when the liquid crystal panel 2 is closed. Unlocking members 5 are provided in the vicinity of the hooking members 3 so as to urge the liquid crystal panel 2 in the opposite direction to the computer body 1. A spring 6 urges the hooking member 3, and a spring 7 urges the unlocking member 5. The inner cover 12 is also provided with holes 18 through which the lower ends of the hooking members 3 are projected from the inner cover 12, and holes 19 through which the lower ends of the unlocking members 3 are projected from the inner cover 12.

Referring to FIGS. 3A and 3C, the hooking member 3 has a circular protuberance 21 on the outer surface so as to be moved with a finger laid on the circular protuberance 21. A claw portion 22 is provided at the lower end of the hooking member 3. On the opposite surface of the hooking member 3, a rod-like key 23, an L-shaped projection 24, a box-shaped spring container 25, and a pair of projections 26a, 26b are provided. An enlarged portion 24a is formed at the end of the L-shaped projection 24, and a spring retainer 25a for retaining one end of the spring 6 is provided in the spring container 25.

The end portion of the metal fitting 14a to which the hooking member 3 is attached is provided with a key groove 31 for slidably holding the key 23, an L-shaped projection groove 32 for slidably holding the L-shaped projection 24, and a spring retainer 33 for retaining the other end of the spring 6 in the spring container 25, as shown in FIG. 4.

In attaching the hooking member 3 to the end portion of the metal fitting 14a, the L-shaped projection 24 is first inserted into the L-shaped projection groove 32. In this case, the enlarged portion 24a of the L-shaped projection 24 is inserted through an enlarged portion 32a provided at the left end of the L-shaped projection groove 32 in FIG. 4. The spring 6, which is a coil spring, is accommodated in the spring container 25 in advance. The left end of the spring 6 is disposed at the left end of the spring container 25 and compressed toward the left end so as to engage the coil spring with the spring retainer 25a having a small height. The hooking member 3 with the spring 6 accommodated in the spring container 25 is caused to slide until the spring retainer 33 engages the other end of the spring 6 and compresses the spring 6. The hooking member 3 is then pressed against the metal fitting 14a and the key 23 is inserted into the key groove 31. In this way, the hooking member 3 is urged toward the end portion of the metal fitting 14a by the urging force of the spring 6. When the metal fitting 14a is screwed to the inner cover 12 by the screw 15 in this state, the lower end of the hooking member 3 projects from the hole 18 provided in the inner cover 12 toward the computer body 1.

## Unlocking Mechanism

In this embodiment, the unlocking member 5 is composed of a rod-like member 43 having protruding portions 41, 42 and a spring rod 44, as shown in FIG. 5. The unlocking member 5 is retained by the end portion of the metal fitting 14a. As shown in FIG. 4, the metal fitting 14a is provided with a hole 51a formed in a spring retainer 51 so as to receive the end of the spring rod 44, and a pair of protruding portion retainers 52 for holding the protruding portion 41 or 42. The upper end of the spring rod 44 with the spring 7 mounted thereon is inserted into the hole 51a. Since the spring 7 is mounted around the spring rod 44, one end of the spring 7 is retained by the spring retainer 51 surrounding the hole 51a. The other end of the spring 7 is retained by the pair of protruding portion retainers 52. In this way, the unlocking member 5 is pushed downward as a whole until the protruding portion 41 is received by the pair of protruding portion retainers 52. In this state, the unlocking member is retained by the metal fitting 14a.

The locking and unlocking operations will now be explained with reference to FIGS. 6A to 6C. As shown in FIG. 6(A), the hooking member 3 is urged toward the shaft of the liquid crystal panel 2 by the compressing force of the spring 6. The claw portion 22 at the lower end of the hooking member 3 is therefore pressed against the proximal end portion of the hole 4 formed in the computer body 1, thereby locking the liquid crystal panel 2 to the computer body 1.

When the hooking member 3 is pulled leftward in FIG. 6B with a finger, the hooking member 3 as a whole moves against the urging force of the spring 6, so that the claw portion 22 at the lower end of the hooking member 3 is allowed to freely move in the hole 4. Then, the unlocking member 5 pushes the surface of the computer body 1 by the urging force of the spring 7, thereby pushing up (rotating) the liquid crystal panel 2. At this time, the lower end of the hooking member 3 is situated on the surface of the computer body 1. If the finger is released from the hooking member 3 in this state, the hooking member 3 is restored to its original position by the elastic force of the spring 6. As a result, the claw portion 22 is situated between the surface of the computer body 1 and the surface of the liquid crystal panel 2, as shown in FIG. 6 (C), thereby unlocking the liquid crystal panel 2 and the computer body 1. Consequently, the operator can easily rotate the liquid crystal panel 2 and set it up.

When the liquid crystal panel 2 is closed, the unlocking member 5, which has elasticity, functions as a kind of buffer. If the liquid crystal panel 2 is about to be closed roughly, the force is suppressed by the unlocking member 5, thereby preventing a damage or the like due to the collision between the liquid crystal panel 2 and the computer body 1. The covers 11, 12 are preferably produced from an ABS resin or the like. The hooking member 3 is preferably produced from POM (polyoxy methylene) having high wear resistance.

## Hinging Mechanism

FIGS. 7A and 7B are a plan view and a side elevational view of the portion of the metal fitting 14 (metal fitting 14 in FIGS. 7A and 7B generically refers to either of metal fittings 14a or 14b of FIG. 2) which connects the liquid crystal panel 2 with the computer body 1.

A bent-up portion 141 is formed at the end portion of the metal fitting 14, and a notch 142 is formed at the end of the bent-up portion 141. Holes 143 are formed by the side of the notch 142. FIG. 8 is a perspective view of the computer body 1. A shaft 101 is penetrated through the bulgy portion of the computer body 1 at which the liquid crystal panel 2 is fixed to the computer body 1. The shaft 101 is provided with a plate portion 102 at both ends thereof, and two holes 103 are formed at the plate portion 102, as shown in FIGS. 9A and 9B. The holes 103 are formed at the positions corresponding to the holes 143 provided in the metal fitting 14.

In mounting the liquid crystal panel 2 on the computer body 1, the plate portion 102 of the shaft 101 is inserted into the notch 142 of the metal fitting 14 in the state in which the LCD unit 13 and the metal fitting 14 are attached to the inner cover 12, as shown in FIGS. 10A and 10B. Since the proximal end of the plate portion 102 is in correspondence with the position at which the metal fitting 14 is attached to the inner cover 12, it is possible to prevent the liquid crystal panel 2 from horizontally moving in the state in which the plate portion 102 is inserted into the notch 142.

The depth of the notch 142 is a predetermined value which makes the positions of the holes 103 coincide with the position of the tap holes 143 in the state in which the shaft 101 reaches the innermost of the notch 142. In this way, since the positions of the holes 103 coincide with the position of the holes 143 in the state in which the plate portion 102 of the shaft 101 is inserted to the innermost of the notch 142, it is easy to fix the liquid crystal panel 2 to the computer body 1 by screwing. That is, all the elements of the liquid crystal panel 2 except the outer cover 11 are thus fixed in this state. Consequently, the checkout and the repair of the computer is facilitated in the state in which the outer cover 11 is removed.

While there has been described what is at present considered to be a preferred embodiment of the invention, it will be understood that various modifications may be made thereto, and it is intended that the appended claims cover all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A display panel which is pivotably attached to the main body of a machine so as to display various data, said display panel comprising:
  - a display panel unit including a display screen;
  - an outer cover for covering the outside of said display panel unit;
  - an inner cover for covering the inside of said display unit, said inner cover being provided with an opening for exposing the display portion of said display unit at the position corresponding to said display portion;
  - a pair of metal fittings which are screwed to side end portions of said display panel unit so as to be rotatably supported by the main body of said machine; wherein said outer cover and said display panel unit are both separately connected to said inner cover such that said outer cover can be removed while leaving said display panel unit attached to said inner cover.
2. A display panel according to claim 1, wherein said display panel is hingedly connected to the main body of the machine, for closing over a bottom portion of the machine.

5,379,182

9

3. A display panel according to claim 1, wherein said inner cover is screwed to said display unit.

4. A display panel according to claim 3, wherein said inner cover is screwed to said display unit together with said metal fittings.

5. A display panel according to claim 4, wherein the main body of said machine includes a rotary shaft provided with a plate portion on both ends thereof; and

each of said pair of metal fittings is provided with a notch into which said plate portion of said rotary shaft is inserted and a hole through which said metal fitting is screwed to said rotary shaft.

6. A display panel according to claim 5, wherein each of said metal fittings includes a first portion which is disposed along the side end portion of said display unit, a second portion which extends toward the inside of said display unit orthogonally to said first portion, and a third portion which extends toward the other end of said second portion orthogonally to said second portion; and said notch is provided on said third portion and said hole through which said metal fitting is screwed to said rotary shaft is provided in said second portion.

7. A display panel according to claim 6, wherein said second portion is provided with a hole through which said metal fittings is screwed to said display unit.

8. A display panel according to claim 4, wherein said display panel unit is a liquid crystal display panel.

9. A display panel according to claim 8, wherein said machine is a personal computer.

10. A display panel according to claim 8, wherein said machine is a portable lap-top computer.

11. A display panel according to claim 8, wherein said machine is a word processor.

12. A display panel according to claim 1, wherein each of said metal fittings includes:

a hooking member which is longitudinally slidably held by the corresponding metal fitting and protrudes from said display panel toward the main body of said machine;

a claw portion provided at the protruding end of said hooking member so as to engage a hole which is provided in the main body of said machine and to lock said display panel to the main body;

a box-shaped spring container which is provided on said hooking member on the side facing said display

10

panel so as to accommodate a coil spring therein; and

a projection piece provided on said metal fitting so as to compress said coil spring in said spring container and urge said hooking member in one direction.

13. A display panel according to claim 12, wherein said hooking member is composed of a plate-like material and is provided with a protuberance on the opposite side to said box-shaped spring container so as to facilitate the movement of said hooking member with the operator's finger.

14. A display panel according to claim 12, wherein each of said metal fittings is provided with a slot having a predetermined size, and said hooking member is provided with a projection which is inserted into said slot so that said hooking member is slidably held by said metal fitting.

15. A display panel according to claim 12, wherein each of said metal fittings holds an unlocking member which protrudes out of said display panel toward the main body of said machine, and said unlocking member is urged toward the main body of said machine by a spring.

16. An information machine for processing various kind of information having a main body provided therein with a keyboard, a computer, and a display panel which is pivotably attached to the main body of said information machine so as to display various data, the improvement comprising said display panel including:

a display panel unit provided with a display unit screen;

an outer cover for covering the outside of said display panel unit;

an inner cover for covering the inside of said display panel unit, said inner cover being provided with an opening for exposing the display portion of said display unit at the position corresponding to said display portion; and

a pair of metal fittings which are screwed to side end portions of said display panel unit so as to be rotatably supported by the main body of said information machine;

wherein said outer cover and said display panel unit are both separately connected to said inner cover such that said outer cover can be removed while leaving said display panel unit attached to said inner cover.

\* \* \* \* \*

55

60

65